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SOUTHWEST FISHERIES CENTER

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To our readers:

With this issue a new era begins for the Center's Report of Activities which has been published at regular monthly intervals since 1964. This was the year when the Tuna Resources Laboratory, under Gerald V. Howard and the California Current Resources Laboratory, headed by Elbert H. Ahlstrom, moved into the newly-built Fishery-Oceanography Center as it was then called.

With the help of the scientific staff, Lillian Vlymen, Special Assistant to the Director, compiled the Report for all of these 20-plus years, for which she has my thanks and appreciation. The "Monthly Report" has reflected many changes in personnel and research emphasis during this time. In 1964, the two laboratories were merged under the first director of the Center, the late Dr. Ahlstrom. In 1967, Dr. Ahlstrom was succeeded by Dr. Alan R. Longhurst, now the Director-General of the Bedford Institute of Oceanography in Canada (this issue carries a photograph of Dr. Longhurst who returned here last month for a brief visit). Dr. Brian J. Rothschild, now a professor at the University of Maryland, became Center Director in 1972 and I succeeded him in 1976.

It is interesting to me that fisheries research at the Center has come almost full circle since the early 1970's. I recently came upon a document written in 1971, as follows: "Work at the Center is organized into four groups, each containing programs and projects related to specific fisheries--temperate and tropical tunas, anchovy and sardines, Pacific and jack mackerel, marine mammals, etc." In 1985 the NMFS decided to plan and budget all of its programs on a fishery by fishery basis. To paraphrase a French proverb Dr. Longhurst was fond of quoting, "It seems that the more things change, the more they are the same." I will leave it to you to figure out the philosophical implications.

Some things have certainly changed. In 1971, the Center housed 25 research scientists and about 50 technicians and administrative staff! We now have about 250 permanent and temporary employees at four locations: La Jolla, Monterey, Tiburon, and Honolulu.

With this issue we have a new editor, Jean Michalski, and I wish her well. Our mission is not only to develop a better understanding of the ocean environment in relation to fishes and other marine resources but to develop feasible options for managing and conserving these resources for the benefit of all Americans.

Izadore Barrett
Center Director

April 15, 1985

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HONOLULU LABORATORY
Honolulu, Hawaii

INSULAR RESOURCES INVESTIGATION

Biological and Physical Phenomena over Seamounts Studied

Dr. George W. Boehlert, Chief, Insular Resources Investigation, continued work on a description of biological and physical phenomena over seamounts. The data were collected on the NOAA Ship Townsend Cromwell, cruise 84-03, during three visits to Seamount No. 72, in the Northern Marianas. Boehlert is working on the manuscript with Amatzia Genin, Scripps Institution of Oceanography.

On the first of the three visits, there were uplifted isotherms above the seamount, and the chlorophyll profiles were significantly different from those in control stations several miles away. These changes, attributed to the interaction of the prevailing currents with topography, were not observed in the two subsequent visits to the seamount over the month following the first visit.

Boehlert also analyzed data from a later cruise, TC 84-05, with help from research assistants Michael P. Seki, Robert L. Humphreys, Jr., and Darryl T. Tagami. They found that there was no clear thermal pattern over Hancock Seamounts. Micronekton, and perhaps larger organisms, migrate off the seamount in the evening and remain in place at distances up to 150 m above the summit of the seamount despite surface currents of up to 30-40 cm/sec.

Densities of several organisms were significantly greater in waters over the seamounts than densities in adjacent waters. On the first of two hydrographic transects, chlorophyll profiles were also abnormal in waters over the seamount and in one of four control stations: very low values were seen near 100 m where normally a peak is observed. Changes associated with potential upwelling at the seamount are being explored, but analysis of the CTD data is necessary. Tagami is working on computer programs to allow analysis of CTD data on laboratory microcomputers. Finally, the discrete-depth plankton samples are being sorted for ichthyoplankton and squid larvae so that patterns in abundance above and away from the seamount can be discerned. (G.W. Boehlert, 808-943-1221)

Otoliths of Larval Snappers Examined

James H. Uchiyama, Fishery Biologist, and research assistant Jeffrey D. Sampaga examined otoliths of the larvae of a snapper, Pristipomoides sieboldii, which had been obtained by artificial spawning experiments conducted on the research vessel, Townsend Cromwell, last summer by research assistant Yara Lamadrid-Rose. A pair of otoliths appeared in the embryo (ca. 1.42 mm) about 24 hours after the egg was fertilized. The eggs hatched 36 hours after fertilization. The newly hatched larvae were 1.49-

1.62 mm standard length and had two pairs of otoliths, 8.9 to 10.0 microns in diameter, consisting of the primordium and core. On the day after hatching, the larvae were 1.86 to 2.11 mm. The otoliths were 13 microns in diameter and had a dark ring, which was not present on otoliths examined on the day of hatching, near the edge of the otoliths. The larvae were 2.11 to 2.41 mm on the second day after hatching and the otoliths were 15 microns in diameter and had two rings. Larvae examined on the third day after hatching showed no growth because their yolk had been exhausted. However, the otoliths were 18 microns in diameter and had three rings. The eggs and larvae were reared in water 23.8°-24.0°C and under constant light. All measurements were made on fixed specimens.

Uchiyama noted that in addition to partially validating the daily increments on the otoliths of P. sieboldii, eggs and larval specimens are now available for identifying eggs and larvae of this species in plankton collections. (J. H. Uchiyama, 808-943-1221)

Gear Tests Conducted on Cruise

Dr. George Boehlert conducted gear trials on LEG IV of Townsend Cromwell cruise 84-06 from December 3 to 5 in waters south of Oahu. Dr. Edmund Nunnallee, a hydroacoustic specialist from the Seattle Laboratory, Northwest and Alaska Fisheries Center, and gear specialists Fredrick Wathne, Seattle Laboratory, Northwest and Alaska Fisheries Center, and Thomas Dunatov, Master of the NOAA Ship John N. Cobb helped in using two midwater trawls and various hydroacoustic equipment. Personnel from the Honolulu Laboratory on the cruise included chief scientist Darryl Tagami, research assistants Raymond P. Clarke, Robert Humphreys, Michael Seki, and fishery biologists Paul M. Shiota and James Uchiyama.

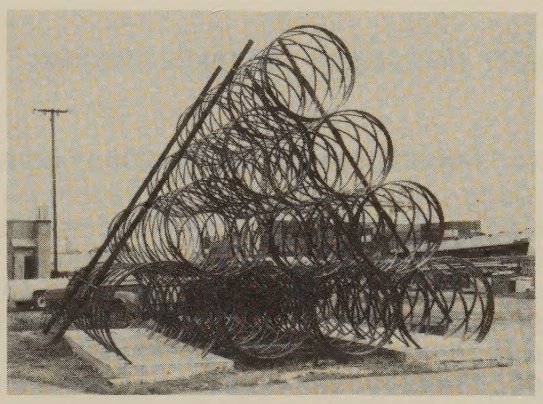
The Diamond 1000 and the Marinovich herring midwater trawls were tested to determine the feasibility of their use on the Cromwell to sample the biological scattering layers observed over and around seamounts in the Hawaiian Archipelago. Three experimental tows were made with the Diamond 1000 trawl, which is a large mesh commercial midwater trawl. The operation of the trawl at slow speeds (3 knots or less) and in calm seas was satisfactory. However, the vessel was inadequate for sustained operation of the trawl at normal towing speed and in normal sea conditions. The Marinovich herring trawl is a smaller midwater trawl with smaller mesh. Seven experimental tows were made with this trawl and the operation and control were much easier than with the Diamond 1000 trawl. In addition, an aimed trawl with the Furuno netsonde attached was successfully conducted through a scattering layer.

During these experimental tows, several modifications were made to the Furuno netsonde (model FNR-400 MK-II) system used to monitor trawl operations on the vessel. On past cruises, this Furuno system performed erratically and the echogram display was intermittent and difficult to interpret. The problem seemed to be inadequate reception of the telemetry signal and difficulty in the positioning and attachment of the headrope unit to the trawl. On this cruise, various adjustments were made on each tow to align the headrope unit properly at near neutral buoyancy. A towed paravane with an extra transducer was also tested to improve the signal reception. The overall usefulness of this system was marginally adequate

and it was recommended that the Honolulu Laboratory use more modern equipment to maximize trawling efficiency.

Nunnallee also gave instructions in the use and calibration of the vessel's echo sounding equipment for qualitative surveys. Presently, the Raytheon (JRC) chromoscope and the Simrad EQ-38 echo sounder (38 kHz) are used in conjunction with other gear to detect biological scatterers in the water column. Nunnallee also suggested modifications in the setup of the chromoscope unit to improve the echogram display. (G.W. Boehlert, 808-943-1221)

Artificial Reef Readied for Deployment



Dr. Jeffrey J. Polovina, Leader, Artificial Reef Program, reports that the fiberglass reinforced plastic artificial reef module (Figure 1) has been assembled and will be placed at a depth of 80 m on Penguin Bank off of Molokai in April. The reef module measures 7 by 6 m (23 by 20 ft) at the base and is 5 m (16 ft) high, weighs 13 tons, and encloses a volume of 108 m^3 (3,800 ft^3). This reef module is the first in a series of modules of various designs which will be placed on Penguin Bank in a flat, sandy area, which is devoid of fish but is about 1 mile from the 200 m drop-off where populations of snappers and groupers are found. The objective of the research is to determine if populations of commercially valuable snappers and groupers will develop around the reef modules, and ultimately, to quantify the impact that artificial reefs can have on the production and yield of deepwater snappers and groupers. It has been estimated that the total area of snapper and grouper habitat in the Hawaiian Archipelago does not exceed 2,000 nmi^2. Penguin Bank alone offers over 500 nmi^2 of flat, sandy habitat in the 50 to 90 m depth range which currently supports a very low density of fish. If artificial reefs placed on this area can create an appropriate habitat for snappers and groupers, then their use on Penguin Bank alone can increase the total snapper and grouper habitat by 25%. (J.J. Polovina, 808-943-1221)

Marianas Deepwater Shrimp Data Analyzed

Dr. Jeffrey Polovina and Robert B. Moffitt, Fishery Biologists, have analyzed the deepwater shrimp sampling data from the Mariana Archipelago. The primary species in the shrimp resource is Heterocarpus laevigatus which has von Bertalanffy growth of 0.3 cm/year, asymptotic length parameters of 5.5 cm, and an instantaneous natural mortality of 0.75. The age of entry to the fishery for H. laevigatus is estimated at about 2.5 years and the age of maturity is estimated at 5 years.

The estimated maximum sustainable yield for all species of Heterocarpus in the 350 to 1,200 m depth range is 250 metric tons (MT) per year and it is estimated that 87% of the yield would come from the southern populated islands and banks. The highest catches for these shrimps are obtained in the 500 to 800 m depth range and consist almost exclusively of H. laevigatus. The annual maximum sustainable yield for this depth range is 180 MT or about 217 kg/nmi^2/year. At an average wholesale value of $7.50/kg, this resource could be worth about $1.4 million annually.

Extrapolating the yield estimate from the Marianas to the Hawaiian Archipelago results in an estimate of annual maximum sustainable yield of about 830 MT. (J.J. Polovina, 808-943-1221)

FISHERY MANAGEMENT RESEARCH PROGRAM

Annual Report for Spiny Lobster Fishery Prepared

Dr. Robert A. Skillman, Leader, Fishery Management Research Program, and Ray F. Sumida, Fishery Biologist, completed the 1984 annual report for the Northwestern Hawaiian Islands (NWHI) spiny lobster fishery. Computer programming assistance for data summaries in the report was provided by Joan P. Draper, Computer Programmer. The report is a requirement of the final fishery management plan for the spiny lobster fishery and it satisfies requests for information from the Southwest Region. Some of the highlights of the fishery in 1984 are given below.

1. The 1984 landings of 290 MT (639,814 pounds) of spiny lobster are the second highest in the history of the fishery, and the slipper lobster catch of 129 MT (284,535 pounds) is the highest on record.

2. Catch (number) of spiny lobster increased from 157,606 in 1983 to 666,842 in 1984, and the catch (number) of slipper lobster increased from 25,610 in 1983 to 284,535 in 1984. This fishery is now considered a two-species fishery.

3. The fishery has expanded. It was based primarily on a single fishing ground and now it is based on three major and four minor fishing grounds.

4. The number of boats increased from 4 in 1983 to 11 in 1984, the number of trips from 19 to 38, the number of days fished from 274 to 823, and the number of traps fished from 76,857 to 377,690.

5. The catch rate of legal spiny lobster in 1984 declined slightly at Necker Island and Gardner Pinnacles, but increased slightly at Maro Reef. Over all grounds, the catch rate declined from 2.1 legal lobster/trap-night to 1.8.

6. The average size of spiny lobster in the landings declined moderately.

7. The catch rates of sublegal and berried spiny lobsters on the different grounds have increased or remained the same, which indicates that recruitment has not been impaired. Overall, the catch rate for sublegals declined from 0.7 to 0.6 lobsters/trap-night, whereas the catch rate for berried lobsters rose from 0.1 to 0.2.

8. The spiny lobster stock appears to be moderately to heavily fished, but healthy in that recruitment to the fishery has not shown a decline and catch rate has not declined precipitously. (R. A. Skillman, 808-943-1221)

PELAGIC RESOURCES INVESTIGATIONS

Paper Completed for Conference

Dr. Jerry A. Wetherall, Leader, Pelagic Stock Assessment Task, completed a paper entitled, "Estimating growth and mortality in steady state fish stocks from length-frequency data." The paper, coauthored by Polovina and Ralston, was prepared for the ICLARM/KISR conference on the Theory and Application of Length-Based Methods for Stock Assessment, held at the Instituto di Technologia della Pesca e del Pescato, in Mazara del Vallo, Sicily, Italy, February 11-16. Due to recent travel cutbacks at the Center, Wetherall was unable to present the paper in person. However, the paper will appear in the Proceedings of the conference, which will be published by ICLARM.

In the paper Wetherall et al. review and discuss three established procedures for estimating growth and mortality parameters of Beverton and Holt, Ssentongo and Larkin, and Powell. These are applicable when length-frequency data are available from a steady state population having exponential mortality and von Bertalanffy growth (or when steady state conditions can be approximated by pooling samples taken over the reproductive cycle). Various types of systematic bias are discussed and remedial measures suggested. Two new estimation procedures are also derived, both superior to the available approaches. The methods are evaluated on the basis of relative bias and precision using Monte Carlo simulation models. In the paper's closing section, the assumption of constant mortality is relaxed, and methods for estimating length-specific parameters are developed. (J.A. Wetherall, 808-943-1221)

New Treatments Tested to Reduce Mortality of Experimental Fish

Research assistant Robert E. Bourke, who is responsible for the care of experimental animals at the Kewalo Research Facility (KRF), reports that he has begun using a new series of treatments to reduce the initial mortality (generally about 75%) of tunas delivered to the KRF. The treatments are based on his master's thesis study of the causes of fish mortality. The treatment consists of lowering the salinity (to about 80% seawater) in the holding tanks for the first several days after the fish arrive at the KRF. The fish are simultaneously treated with the antibiotic

Furacin (at 1 ppm) to reduce the effect of skin abrasions that are inevitable during capture, transport, and transfer operations. The first batch of skipjack tuna, Katsuwonus pelamis, treated in this manner, appeared to respond positively, although more work is needed to prove the efficacy of these procedures. (R.W. Brill, 808-943-1221)

DATA MANAGEMENT AND TECHNICAL SERVICES

Data Management Activities Reported

Fletcher V. Riggs, Chief, Data Management and Technical Services (DMTS), reports that the first phase in the development of a system for tracing or accounting for all the wiring and hardware elements of the Honolulu Laboratory's computer systems was completed. Charles K. Pribyl, Computer Programmer, has identified and labeled each element (line or peripheral) and has physically traced the connections throughout the main building and Annex A. The next phase will be the incorporation of this information into a data base to simplify the process of locating available communications lines for new peripherals as well as troubleshooting existing lines.

A software package designed to remove all backup files from the Molecular system is up and running. Wayde S. Higuchi, Computer Programmer, has written the program which is now used in the semi-weekly Molecular backup procedure. After all files (including backup files) have been copied to tape, all backup files are deleted from the system to provide more free disk space. The program (PURGE), along with documentation, is available for other systems upon request.

Fred R. Frizelle, Computer Programmer, has completed work on the first (and most complex) of several programs on the Mohawk Data Sciences data entry systems for checking and editing monk seal behavior data collected by the Marine Mammals and Endangered Species Program. This elaborate association-checking program ensures that observations made on the interaction of one seal with another are properly recorded on the records for both seals. This duplicate recording of information is not often done in the field at the time of the observation. Programs are now being written for checking other potential data problems.

Janet L. Pappas, Computer Programmer, has made several significant improvements in the ability of Data Services to assist laboratory computer users: 1) user manuals have been reproduced and the Honolulu Laboratory's software library is being inventoried and organized; 2) individual training sessions have been conducted on the use of word processing, data base, and spread sheet software packages; and 3) a newsletter (ADP Bulletin) is now distributed on an as-needed basis to inform users of system changes and to assist staff in the use of new hardware and software.

The Financial Reporting System (FRS) was installed on the Honolulu Laboratory Molecular computer system in January. Procurement transactions can be entered locally for the first time in over a year. Although at present no summarization reports are available locally, the current

arrangements are still a vast improvement over the past since there are no longer delays caused by mailing coded entry forms and verification reports. Data entered for February was transferred between laboratories for the first time over the telephone system. Although not yet completely free of problems, this method of data transfer appears very promising and is an improvement over the postal or messenger service. (F.V. Riggs, 808-943-1221)

COASTAL FISHERIES RESOURCES DIVISION
La Jolla, California

U.S.-Mexico Hold Preliminary Talks on Joint Research Program in Pacific

In the Pacific, the U.S. shares with Mexico several economically important species of fish. These include the northern anchovy whose catch exceeded 103,000 metric tons in 1983 (90,000 mt were taken by Mexico), the Pacific sardine, a mainstay of several canneries in Mexico, hake, bonito, and a variety of sport fish.

In recent years, Mexico has not responded to the attempts of the Southwest Fisheries Center to enter into a meaningful dialogue on the biology and management of these species, that is, until February 15, 1985. On that day at the Southwest Fisheries Center in La Jolla, California, the newly-appointed Director of the Instituto Nacional de Pesca, Ing. Jose Antonio Carranza, and key members of his staff met with California Cooperative Oceanic Fisheries Investigations representatives: Dr. Izadore Barrett, Director, and Reuben Lasker of the Southwest Fisheries Center, Messrs. Rick Klingbeil and Herb Frey of the California Department of Fish and Game, and Professor Joseph Reid of the Scripps Institution of Oceanography.

Much of the ensuing discussion between these principals dealt with the writing of a general draft agreement between CalCOFI and INP regarding a joint research program, training agreements and scholarships for Mexican scientists, research vessel permits, etc. The principals in this meeting plan to meet again in Ensenada, Baja California Mexico, in April. (R. Lasker, FTS 893-6212)

LEFT TO RIGHT: Jose Luis Granados, Ricardo Thompson, Maria Concepcion Rodriguez de la Cruz, Harry Mazal, Joseph Reid, Jose Antonio Carranza, Hernan Mateus, Izadore Barrett, Herbert Frey, Pablo Arenas Fuentes, Rene Gonzalez Cantu, Richard Klingbeil, Reuben Lasker.

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Meeting on Oceanography and Tuna Movement Dynamics Held

From January 7 to 9, a workshop meeting on oceanography and tuna movement dynamics was held at the Southwest Fisheries Center auditorium. The meeting, chaired by Dr. John Hunter, was the second of a series of three workshops to be held on tuna movement dynamics. During the first two days of the meeting, the participants discussed how tuna movements are affected by environmental conditions and approaches that could be used in future investigations. The last day was devoted to reviewing the notes from the first two days of discussion and a business meeting of panel members. The panel provides continuity among the series of three workshops and is responsible for writing a final report; various experts are invited to participate with panel members to discuss the issues of each workshop. The final workshop meeting is scheduled for 25-27 March 1985. The focus of this meeting will be on measurement of tuna movements using sonic tracking, and other fishery independent means of defining tuna movements. (J. Hunter, FTS 893-6220)

Predator-Prey Relationships Studied

To understand predator-prey relationships in the ocean, predators need to be identified. Predation on larval fishes may be a major cause of larval fish mortality, although the evidence is not conclusive in cases where predator gut contents cannot be identified through visual analyses. Gail Theilacker, Fishery Biologist, has been testing the feasibility and sensitivity of a serological, enzyme-linked immunosorben assay (ELISA) to determine whether euphausiid crustaceans eat anchovy eggs and larvae in the ocean. Earlier laboratory feeding experiments showed that Euphausia pacifica adults will eat anchovy larvae.

Rabbits were immunized and boosted with purified anchovy egg yolk protein. Using the ELISA and a serum titre of 1:500, Theilacker found that antisera from the initial bleed detected as little as 1 μg of yolk protein. The secondary injection of yolk protein into rabbits increased the sensitivity of the collected sera 12 fold: a 1:1500 dilution of the serum detected as little as 0.25 μg yolk protein. The dry weight of an anchovy egg, presumably 80-90% yolk protein, is 21 μg. Both yolk and antisera preparations were robust, and maintained their reactivity for at least one month at 3-5°C. Yolk and serum preparations were stored at -80°C.

For the ELISA procedure, the antigen (anchovy yolk protein) was immobilized on nitrocellulose and then reacted with the primary antibody to anchovy yolk protein which was produced in rabbits. The resulting antigen-antibody complex was treated with a secondary antibody which had been tagged with the enzyme horseradish-peroxidase. This secondary antibody was produced in goats by immunizing them with rabbit antibody. The complex on the nitrocellulose can be compared with a sandwich--anchovy yolk protein + rabbit antibody + goat-rabbit antibody + horseradish-peroxidase tag. Peroxidase activity was visualized on the nitrocellulose paper with a dye.

Theilacker found that anchovy yolk protein was present, which was indicated by a pink/brown color reaction.

Euphausiids, Euphausia eximia, were collected for Theilacker aboard the NOAA Ship David Starr Jordan by Jack Metoyer and Sharon Hamer. In the laboratory at SWFC, the control group of euphausiids were fed algae for 48 hours to clear their guts, and the test group was fed Day 3 anchovy larvae. All animals were frozen in liquid nitrogen initially and subsequently stored at -80°C.

Theilacker tested several euphausiid-preparation procedures using the control euphausiids. It was necessary to find an effective method for extracting the yolk protein from the euphausiid guts, and to determine whether yolk protein that was degraded by proteolytic enzymes (secreted by the euphausiid hepatopancreas) was recognized by the primary antibody. In addition, Theilacker needed to verify the antigenicity of the yolk proteins found in eggs and yolk-sac anchovy larvae of various ages.

Theilacker tried several techniques to prepare the euphausiids and several buffer systems to solubilize the yolk from their guts. Preparations included sonicating, extracting an animal (cut in half) in buffer overnight, and extracting the dissected stomach and gut.

Antigenicity of degraded yolk protein and the ability of the buffer systems to maintain yolk protein stability were determined by incubating known amounts of yolk protein (prepared from 24 h and 36 h eggs and from Day 1, 2 and 3 yolk-sac larvae) with buffer homogenates of the euphausiid hepatopancreas (which is unpigmented). Results from these tests revealed that degraded yolk from eggs and larvae of all ages was recognized by the primary antibody. A simple Tris/EDTA buffer maintained yolk protein stability as well as the complex buffer systems containing proteolytic inhibitors and competitors. Some activity was lost in the sea water buffer.

All aspects of the use of a serological assay to determine the euphausiid/anchovy predator-prey relationship have been addressed. The rabbits produced a specific antibody of high titre that reacts with nannogram quantities of anchovy yolk protein. Antibody reactivity is not reduced by euphausiid digestion, which causes proteolytic degradation of the major antigenic yolk proteins. Antigenicity of the yolk proteins is maintained during egg and larval development. (G. Theilacker, FTS 893-6331)

Studies of Feeding Behavior of Northern Anchovy Larvae Studied

Laboratory experiments on the feeding behavior of larvae of the northern anchovy have been conducted by Patti Schmitt, NRC-NOAA Post-doctoral Fellow in the Coastal Fisheries Resources Division. The experiments are designed to assess how feeding rate and prey-size selectivity change with larval length and prey concentration. Impetus for the research comes in part from the findings of Richard Methot, Fishery Biologist, who observed that growth rate in late anchovy (20-35 mm SL) was slower than the growth rate during the early larval or juvenile phases in field-collected specimens. These experiments should provide a better

understanding of larval foraging behavior and abilities at various lengths, by determining how prey concentration and prey-size distribution affect the amount of food ingested.

Laboratory-reared larvae of 10 mm SL, 20 mm SL, 30 mm SL, and 40 mm SL are being used in the experiments. The larvae are acclimated and starved for 24 hours before each trial. Wild plankton, consisting mainly of nauplii, copepodites, and adults of various calanoid copepods, is offered to the larvae in two concentrations: 10 organisms per liter and 100 per liter. The larvae are allowed to feed for 30-60 minutes, and then are anesthetized and preserved. The size-composition of plankton is determined for each experiment, along with the numbers and sizes of all prey found in the larval guts.

Preliminary results for larvae of 20 mm SL and 40 mm SL indicate that both sizes tend to consume nauplii in much lower proportions than available, and to consume copepodites and copepods in higher proportions than available. There appears to be no strong tendency for larger fish to be more selective for larger prey, which is contrary to what Schmitt expected. The main difference between the two sizes of fish is in their feeding rates. Feeding at 100 prey/liter, 20 mm fish consumed on average 2.7 prey/minute, while 40 mm SL fish consumed 9.5 prey/minute. At 10 prey/liter, both sizes of fish had very low feeding rates: 0.3 prey/minute for 20 mm fish and 0.2 prey/minute for 40 mm fish.

Width: volume: dry weight relationships have been determined for fresh samples of mixed-species copepod collections. This information will be used to express feeding on the basis of biomass as well as numbers of prey of various sizes consumed. (P. Schmitt, FTS 893-6352)

ECOLOGY AND TAXONOMY OF FISHES, CALCOFI

CalCOFI Fish Egg and Larva Data Edited

The staff of the Ecology and Taxonomy of Fishes group is working closely with Richard Charter, Paul Smith and their staffs editing the CalCOFI multispecies fish larva data. The purpose of this project is to enter all CalCOFI fish egg and larva data in the computer system, ensure the accuracy of the data base through an editing system, produce a series of reports on the data, and perform analyses on important components of the larval fish assemblages. The data base spans a period of 25 years and includes samples from about 190 cruises and over 32,000 stations. The coding and computer entry were completed over the past 2 years by Rich Charter and his staff in close cooperation with the staff of the Taxonomy Group. The initial editing process consists of comparing print-outs of the data with the original identification sheets and making the necessary corrections and follow-up edits. This process has been completed for 16 CalCOFI survey years from 1954 to 1969 by staff members David Ambrose, Morgan Busby, Barbara MacCall, Elaine Sandknop and Betsy Stevens working with Rich Charter, Larry Zins and Debbie Snow.

Dr. Paul Smith and his staff members, Jim Ryan and Celeste Santos, are helping with the second editing phase. They have analyzed the data base statistically, and also produced geographic and seasonal summaries of the data. Dr. H. G. Moser has been working with the summaries and identifying geographic and seasonal outliers in the data that will require reexamination of the original samples. Also Moser and Rich Charter have been making taxonomic and code changes in the data base and working out a format for the data reports. (H.G. Moser, FTS 893-6239)

Volume on Developmental Stages of Marine and Fresh Water Fishes Published

In January 1985, Ontogeny and Systematics of Fishes was distributed. The publication of this volume is the culmination of a 4-year project to summarize and publish all available information on the developmental stages of marine and fresh water fishes. Four National Marine Fisheries Service scientists were responsible for the publication of this volume: H. Geoffrey Moser, Southwest Fisheries Center, editor-in-chief, William J. Richards, Managing Editor, Southeast Fisheries Center, Michael P. Fahay, Northeast Fisheries Center, and Arthur W. Kendall, Jr., Northwest and Alaska Fisheries Center.

The four scientists and Daniel Cohen, Los Angeles County Museum, and Sally Richardson, Gulf Coast Research Laboratory, organized a symposium which was held at the University of California, San Diego, in August 1983. The symposium attracted 250 specialists on the early life history of fish; the specialists came from 10 foreign countries and the U.S. The range of papers reflected the present state of taxonomic knowledge of the major fish groups, reviews of current principal hypotheses of systematic relationships, and discussions of the contributions of early life history characters to these hypotheses. After the symposium, the four editors prepared and edited the manuscripts, which reflected the ideas and concepts generated during the symposium.

The volume was published by the American Society of Ichthyologists and Herpetologists as the first volume in their Special Publication Series. It is an up-to-date compendium of knowledge on the taxonomic status of all major fish groups, their early life history stages, the revolutionary relationships within and between the groups, and techniques used to study them. The book is an appropriate memorial to Dr. Elbert H. Ahlstrom who evolved the systematics and methodology for identifying the eggs and larvae of fishes of the California Current region during a government career spanning 40 years. (H.G. Moser, FTS 893-6239)

Visiting Japanese Scientist Continues Work on Deep Water Flatfish

Dr. Kunio Amaoka, visiting professor from the University of Hokkaido, Japan, has completed 6 months of his 9 months research visit at the Center. He has completed a manuscript describing the morphological changes in head structure in the deep water flatfish, Chascanopsetta crumenalis, and has been studying 14 genera of flatfishes which occur in the eastern Pacific, including the California halibut. His work centers on characters of the

adult stages, but he will include larval characters in his analysis. Three of his students will visit the laboratory in April to confer with him and with members of the staff. Dr. Amaoka will leave the laboratory in May and travel to the Smithsonian Institution in Washington, D.C. and to Europe to complete his sabbatical. (H.G. Moser, FTS 893-6239)

SURVEY SYSTEMS DEVELOPMENT AND EVALUATION

First Phase of Ecological Summary Completed

Dr. Paul E. Smith, Jim Ryan, and Celeste Santos have completed the first phase of the work with Dr. Geoff Moser on an ecological summary of the fishes of the California Current, the coastal currents complex and the adjacent water masses in the subarctic, transition between the subarctic and central water masses, the central water mass, and the subtropical water mass. Smith, Ryan and Santos have plotted about 275 species of fish on a map so they can determine the geographic outliers and they statistically summarized the data for outliers. They have also examined the seasonality of the incidence of the larvae for the most common species.

To establish the relation between spawning distributions and water mass boundaries, Smith, Ryan and Santos have assembled some selected species with the hydrographic casts taken on the same stations. Since the plankton samples have been integrated from 140 meters to the surface, only the upper layer salinity measurements have been used. These salinity measurements are highly intercorrelated by depth. The following table is an example of the intercorrelation of salinity measurements at standard depths for stations where hake (Merluccius productus) larvae were taken.

Relationship among salinities at indicated depths
and salinity at 10 meters
1954-1960 hake

Depth (m)	Correlation	Determination
0	0.994	0.988
20	0.994	0.988
30	0.983	0.966
50	0.934	0.872
75	0.792	0.627
100	0.630	0.397
125	0.586	0.343
150	0.583	0.340
200	0.653	0.426

(Paul E. Smith, FTS 893-6346)

New CalCOFI Data Base Created for CTD and STD Files

Oceanographic data, including temperature, salinity, oxygen and density, have been systematically collected at a network of stations off California and Baja California since 1950. These elements were historically measured at discrete depths to 500 meters, or more, and have been published in data reports by Scripps Institution of Oceanography and accumulated in computer files at SWFC. Recently, Oceanographer Larry Eber has arranged with Professor Joseph Reid, SIO, and Ken Bliss, SWFC, to get copies of data from STD (Salinity-Temperature-Depth) and CTD (Conductivity-Temperature-Depth) instruments to update the SWFC files. These data are recorded continuously at the time of measurement, and are later digitized at one or two meter intervals. Since this provides much finer resolution than data measured at discrete depths, the STD and CTD data will be maintained as a separate data base for use in investigation of fine scale vertical structure.

Celeste Santos performed the data processing required to edit the identification fields, reformat the data, and compute and insert density and geopotential anomaly values from temperature and salinity values contained in the source files. This work has been completed for all the data received to date, comprising 17 cruises from January 1978 through July 1984. (L. Eber, FTS 893-6282)

XBT Reliability Study Completed

In September 1979, staff of the Southwest Fisheries Center conducted an experiment aboard the NOAA Ship David Starr Jordan, in cooperation with Sippican Corporation to test the reliability of data obtained with XBT (Expendable Bathythermograph) probes. The experiment entailed simultaneous casts from port and starboard sides of the ship at intervals of 5 to 10 minutes. Each launcher was connected to its own analog recorder, and the signals from each recorder were fed to an analog to digital converter, which was on line with the HP9825 shipboard computer system. A special program was provided by Ken Bliss (SWFC) to interrogate the A-D converters at time intervals corresponding to depth intervals of 3 meters in the layer above that depth, and 30 meters below 150 meters. The incoming signals were converted to temperatures and stored on magnetic tape and printed.

Larry Eber has recently completed an analysis of the data from this study, which will be issued as an administrative report. The means and standard deviations of differences at common depths for each pair of simultaneous casts were computed for three layers, 0-75 meters, 75-150 meters and 150-540 meters. Based on 128 paired casts, 84% of the mean differences were within the range -0.2 to 0.2°C in the upper layer, 79% were within this range in the intermediate layer, and 71% in the deep layer. The standard deviations of the differences were mostly less than 0.1°C. Only those casts with no apparent malfunctions were selected for comparison. (L. Eber, FTS 893-6282)

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Evaluation of Integrated Population Assessment Model Continued

Dr. Richard Methot, Fishery Biologist, has developed a population assessment model which allows simultaneous evaluation of several types of data including age composition, catch and various estimates or indices of abundance. The simultaneous evaluation of several sorts of information can result in a description of the population which is more complete and precise than that obtained from the individual sources. The SWFC has several time series of indices of abundance of northern anchovy but each contains a substantial amount of measurement error. Inclusion of age composition data constrains the year to year fluctuations in the observations of abundance. Increased abundance is likely when the age composition data indicate that recruitment has been good; when recruitment is poor, abundance can only decrease by an amount in accordance with natural and fishing mortality. The goal of the population assessment model is a set of estimated abundances which are more accurate than the observed abundances.

The effectiveness of the model was tested on 81 sets of simulated data. Each data set contained 15 years of observations. The observations were: catch, catch age composition, a survey estimate of biomass, and a survey estimate of age composition. Three kinds of variability were included in the simulated data. The first is vital rate error. The population assessment model assumes that age-specific natural mortality and age-specific availability to the fishery are constant over time. In the simulations which produced the test data, these rates were caused to vary over time. Therefore the model could never exactly reproduce the simulated population--it could only approximate it. The second source of error is ageing error; a fixed fraction of the sampled fish in each age class was misassigned into the adjacent age class. This tends to "fill in" weak year classes with misaged fish from adjacent strong year classes and results in the observed age compositions being "flatter" than the true age compositions.

The third source of error was biomass measurement error. The question is: Are the biomasses estimated better by the model than by the direct measurements of biomass? In general the model provided a large improvement in the estimates. When biomass measurement error was moderate or high and vital rate error was low or moderate, the model's estimates of biomass were much better than the direct measurements. Ageing error did not interfere with the model's ability to estimate the true biomasses and the model did a good job of estimating the level of ageing error. The estimated biomasses often were worse than the direct measurements when biomass measurement error was low or vital rate error was high. In the first case the inclusion of age composition data could not improve on an already very good estimate and in the second case the violation of the constant vital rate assumption was so great it provided misleading information on changes in the population's abundance. (R. Methot, FTS 893-6225)

The Anchovy Biomass Represented by One Sampled Egg

The spawning biomass of the central subpopulation of northern anchovy is estimated each year by the SWFC, as a requirement of the Anchovy Fishery Management Plan. Recent estimates have been made by the egg production method, which requires numerous small-volume (0.05 m) plankton samples. While sampling is underway, these samples are "scanned" at-sea, giving a rough estimate of the number of anchovy eggs found at each station. These preliminary counts have proven to be useful for purposes of adaptively modifying the geographic coverage of the survey. Previously, relative egg counts have been the basis for making these decisions.

Statistician Andrew Bindman has developed a more useful rule-of-thumb for interpreting these preliminary egg counts. Using historical data, he has calculated the incremental spawning biomass represented by one "scanned" egg. This problem is equivalent to calculating the daily egg production rate which gives a standing crop of one anchovy egg. This value, combined with the other historical parameter values, and assuming standard 4-mile station spacing and 10-mile line spacing, gives an average spawning biomass of 46 tons per "scanned" egg. The range of variability is plus-or-minus 15 tons. If lines or stations are spaced more widely, the biomass value should be increased proportionally. (A. MacCall, FTS 893-6221)

Continued Development of Groundfish Limited Access Study

Dr. Dan Huppert, Industry Economist, has made progress in establishing a Working Group to study and evaluate alternative means of limiting access to Pacific coast groundfish. Recent developments in the Pacific coast groundfish fishery have led many industry and agency representatives to seek new management methods. The developments are (1) rapid growth in the trawl fleet between 1976 and 1982, (2) increasingly severe restrictions on allowable take of *Sebastes* species, (3) reduced prices for some fish categories, and (4) financial stress and failure among owners of more recently constructed trawl vessels. Aggravating the situation is the contemporaneous drop in Pacific coast salmon, Dungeness crab and pink shrimp fishery catches. The Fishermen's Marketing Association, headquartered in Eureka, California, and the Pacific Fishery Management Council, are currently supporting a trawl license moratorium effort, seeking uniform State legislation is Washington, Oregon and California.

Although it is unclear that introduction of a trawl license limit can allay the current economic problems, future episodces of rapid fleet expansion could be forestalled by any one of a number of access limitations. Recognizing that there are several alternative means of limiting access--each with its own administrative, economic and social consequences--the Working Group on Limited Access will analyze and evaluate the most commonly discussed variants.

During the past 2 months Huppert has recruited members of the Working Group. With the help of Southwest Regional Director Charlie Fullerton and moral support from the Pacific Fishery Management Council, he has now drawn up a cooperative agreement with the Pacific Marine Fisheries Commission which formalizes joint effort and funding of certain parts of the planned

study. Also, Huppert has worked with Ed Ueber of the Tiburon Laboratory who will chair a Groundfish Alternatives Management group (GAM) made up of industry spokesmen and State agency representatives. The Working Group and GAM are scheduled to kick off the study with a joint meeting at San Francisco State University on March 28-29, 1985.

The limited access study will continue during the next 18 months. A final report will then be presented to industry, PFMC, and State agency. The study will focus on economic, administrative, and conservation aspects of both license limitation and Individual Fisherman Quotas. This will include quantitative analysis of economic costs and benefits associated with different initial rights allocations, post-allocation rules on transferability, and geographical-technological limitations.

Economic analyses will be performed by NMFS economists based upon PACFIN research data, cost and earnings information, and specially collected price and technological information. In preparation, Dale Squires, Industry Economist, contacted fishing fleet spokesmen, port agents, and State agencies to obtain prices and wages pertinent to the trawl fleet. Squires also worked with Charles Korson, SWR Industry Economist, during late February to interpret and code cost information from the financial aid program. (Daniel Huppert, FTS 893-6261)

OCEANIC FISHERIES RESOURCES DIVISION
La Jolla, California

TUNA/BILLFISH ASSESSMENT

Age Structure of Albacore Population Investigated

Fishery biologist David Holts, Earl Weber and Norm Bartoo have recently analyzed the results of their gillnet sampling experiment conducted last August. The aim of their research was to provide an unbiased estimate of the size structure for the local albacore population using passive fishing gear.

The Pacific albacore is harvested by several fisheries, and the fisheries catch different sizes of fish and use different types of fishing gear. To date, the only measure of the size structure for this population is that derived from the commercial troll and baitboat catches. These gears do not provide an unbiased sample of the underlying population from which they are taken. In the experiment, gillnets, a less selective gear, were used to sample the population.

The sampling plan included chartering the commercial gillnet vessel, Steel Fin II, to set and retrieve the specially designed gillnets. These nets consisted of several different mesh sizes from 4 to 10 inches (in one-inch intervals) and were fished in various different depth strata from the surface to below the thermocline. A total of 12 night and 2 daytime sampling sets were made at depths from 1 to 20 meters. Time needed for retrieval was approximately three to six hours, depending on the number of fish caught and sea conditions. The length of the set averaged 11.3 hours.

The gillnet catch included 454 albacore, 276 skipjack tuna, two bigeye tuna and several incidental species (Table 1). The F/V Steel Fin II also sampled the population using the commercial trolling gear to compare catches from the gillnets. This produced 513 albacore and 155 skipjack. Although the gillnet captured a slightly wider size range of albacore, both gears appeared to capture one main size class (Figure 1).

The cumulative length frequencies were plotted on probit paper and used to develop gear selectivity curves. A complete net selectivity analysis was not possible because too few or no albacore were caught in some mesh sizes. Where possible, however, selectivity curves were fitted to the data and provide some useful information. Selectivity curves for mesh sizes 6.0, 7.0 and 7.4 inches are shown in Figure 2. The slopes of the lines are approximately the same indicating homoscedasticity in the relationship between size of albacore caught and the different mesh sizes.

The horizontal and vertical catch distribution within the net varied in several ways. Generally the catch tended to be clumped or grouped into one or more sections of the net. Often fish would be hauled aboard in groups

of three or more and long sections between the groups would be empty. The fish were rarely scattered throughout the net. Groups within each set also tended to be located at similar depths in the net. With only one exception all catches came from above the steepest part of the temperature break in the thermocline. In addition to albacore and skipjack tuna, there were 11 other species of fish taken by gillnet (Table 1).

Table 1. Incidental catch taken in gillnet.

Bigeye tuna	Thunnus obesus	2
Bullet mackerel	Auxis rochei	13
Pacific mackerel	Scomber japonicus	12
Jack mackerel	Trachurus symmetricus	8
Swordfish	Xiphias gladius	5
Blue shark	Prionace glauca	332
Bigeye thresher	Alopias superciliosus	1
Bonito shark	Isurus oxyrinchus	34
Scalloped hammerhead	Sphyrna lewini	5
Pacific pomfret	Brama japonica	5
Louvar	Luvcrus imperialis	3

There is no way to estimate fish loss due to sharks, although net damage was heavy during some sets. Several fish were recovered from the net which had been badly mauled by California sea lions (Zalophus californianus). The sea lions were observed during two sets. No sea lions were tangled in the net.

This study shows that gillnets are a useful sampling tool for albacore and that it is possible to quantify the effects of gear selectivity with adequate sampling results. With an increase in sampling stations, an adequate sample size can be obtained that will allow for a rigorous statistical analysis. This in turn can provide an unbiased estimate of the age structure of the local albacore population. (D. Holts, FTS 893-6324)

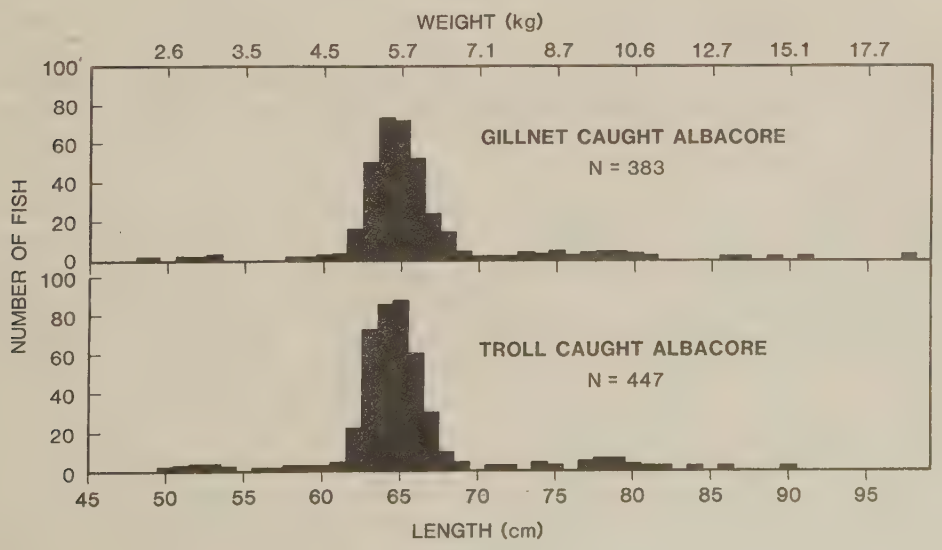


Figure 1. Size composition of the albacore catch by trolling and gillnet.

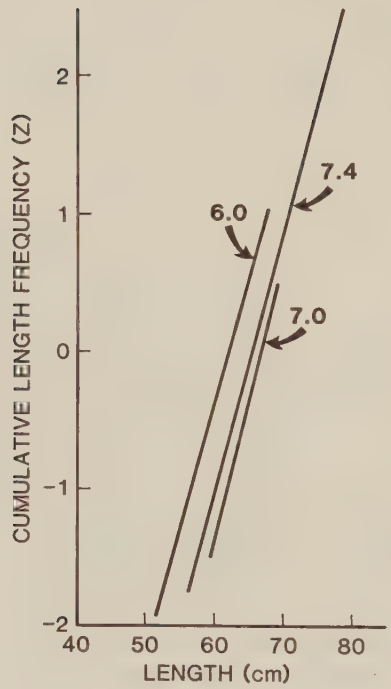


Figure 2. Selectivity curves for mesh sizes 6.0, 7.0 and 7.4 inches. Similar slopes indicate similar variances in the three mesh sizes.

Tagged Black Marlin Migrates Record Distance

James L. Squire, Fishery Biologist and coordinator of the Cooperative Marine Game Fish Tagging Program in the Pacific, recently received a tag recovered from a black marlin that had been tagged in January 1983. The fish had traveled 5,763 nautical miles from the point where it had been tagged, a record for a tagged marlin in either the Atlantic or Pacific Ocean.

J. P. Carlier of Paris, France, tagged the fish off Cabo San Lucas, Baja California, Mexico, in January 1983 with a tag distributed by the SWFC. A Japanese long-line fishing boat, the NO. 10 Kinnei-Maru, recaptured the fish 613 days later west of Norfolk Island in the southwest Pacific, about 35 miles northwest of the northern tip of New Zealand. The fish was identified as a male black marlin, weighing 58 kg. It traveled from the northern (23°N) to the southern (31°S) hemisphere at an average speed per day (based on the straight-line distance) of 9.4 nautical miles. After confirming this record with the staff of the National Marine Fisheries Service, Southeast Fisheries Center in Miami, Florida, which conducts a billfish tagging program in the Atlantic and Gulf of Mexico, Squire established that this was indeed a record migration for a tagged marlin.

When Carlier made the decision to tag and release the black marlin, he joined a growing group of concerned anglers who are now tagging and releasing their fish in the major oceans of the world to increase the knowledge of game fish migration patterns and help scientists to design better programs for conservation and management of commercial and marine sport fishery resources. Although the staff of the Marine Game Fish Tagging Program has concentrated on obtaining information for marlin, sailfish, and swordfish, other large gamefish such as yellowtail, roosterfish, dolphin, wahoo, and various tunas are also included in the record keeping.

For their help, Squire will send both Carlier and the captain of the Japanese longliner, which recaptured the marlin, a tagging award issued by the Cooperative Marine Game Fish Tagging Program. (J. Squire, FTS 893-6376)

MARINE MAMMAL ASSESSMENT

Harbor Porpoise Surveyed

Dr. Jay Barlow, Operation Research Analyst, and Aleta Hohn, Zoologist, recently completed a research-vessel survey of harbor porpoise along the coastlines of California, Oregon, and Washington. Harbor porpoise, Phocoena phocoena, are small, near-shore marine mammals that are only distantly related to the more familiar dolphins. The 54-meter NOAA research vessel McArthur was used to survey a narrow coastal strip from Cape Flattery, Washington, to Point Conception, California, from January 21 to February 9, 1985. The same areas had been surveyed on a harbor porpoise cruise in September 1984. The purpose of the cruise was to provide additional data for population size estimation and new information on seasonal changes in harbor porpoise distribution.

As was the case for the 1984 cruise, execution of the harbor porpoise survey was a collaborative effort involving personnel from several agencies and universities. Barlow, cruise leader, and Hohn, of the SWFC were joined by Joanna Flanders and Barbara Taylor of the National Marine Mammal Laboratory for the first leg of the cruise from Seattle to San Francisco. On the second leg, from San Francisco to Monterey, the survey crew included Susan Chivers, Sandra Hawes, and Jeanie Wexler from the SWFC, Sandy Diamond, California Fish and Game, Greg Silber, University of California, Santa Cruz, and Michael Newcomer and Keiko Sechiguchi, both from Moss Landing Marine Laboratory. The final leg, from Monterey to San Francisco, included Barlow, Chivers, Diamond, and Wexler. The winter survey was very successful due to the cooperation of all involved.

During the course of the survey, observers counted 89 groups of harbor porpoise with an average group size of 2.36. A secondary objective was to record sightings of all crustacean species, with particular attention to pilot whales in the Channel Islands of California. Nine species of cetaceans were seen. Most numerous were the southerly migrating gray whales (321 sightings). Other notable sightings included four groups of

common dolphins (one as far north as Monterey) and two pods of killer whales (both in the Monterey-Santa Cruz area). One group of about 14-20 pilot whales was seen along the coastline of Santa Catalina Island. These data will be entered onto a computer data base to be used for future analyses.

Despite very good sighting conditions, however, the number of harbor porpoise sightings, 89, was considerably less than the 302 sightings that were seen on the 1984 survey. The reason for this difference is not readily apparent and will be the subject of future study. Preliminary results from the cruise have, however, revealed some interesting information about seasonal changes in harbor porpoise distribution. In September, four areas of high abundance of harbor porpoise were identified. On the recent cruise, only two of these areas still showed a high abundance of harbor porpoise. These results imply that relatively large scale movement patterns may exist. Such movements may be responsible for the apparent change in overall abundance observed between September and January.

Much additional work will be needed before an accurate population estimate for harbor porpoise can be made. One of the greatest remaining uncertainties is how far from the coastline the harbor porpoise range. Other important questions include how long are typical dive times and what is the probability of missing harbor porpoise when sighting from a survey vessel or an aircraft. Future research at the SWFC will be directed towards answering these pressing questions. Each year, an estimated 50 to 200 harbor porpoise die in coastal gill nets. Without knowing the size of the harbor porpoise population, it is impossible to evaluate the significance of these deaths. (J. Barlow, FTS 893-6263)

Pilot Whale Aerial Surveys Completed

A series of aerial surveys over the Southern California Bight were conducted during December 1984 and January 1985 to estimate the numbers and distribution of pilot whales in the area. Scientists who participated in these surveys were Chuck Oliver, Chief Scientist, Steve Reilly of the SWFC, and John Scholl and Larry Heitz, California Department of Fish and Game.

Short-finned pilot whales, Globicephala macrorhynchus, have been reported off the coast of California year round, with seasonal increases south of Point Conception during the months of November through February. The seasonal increase off southern California is thought to be related to the spawning season of market squid, Loligo opalescens, which usually peaks during December and January south of Point Conception. Squid have been shown to be a major food item for pilot whales. The squid fishery is concentrated around the offshore islands (primarily Santa Catalina, Santa Cruz, Santa Rosa and San Clemente) and a nearshore area between Point Dume and Point Hueneme. Aerial observations of pelagic resources made during 1963-1978 also identified these areas as having the greatest number of sightings of squid. The fishery for squid involves two methods: the use of purse-seine, or "round haul" nets, to capture schools of squid, and the use of dip nets to capture squid attracted to lights suspended over the water. The competition for squid between the squid fishery and the pilot whales has resulted in a potential mortality for the whales due to

entanglement and a loss to the fisherman in either squid catch or gear damage.

As a result of this fishery interaction and the potential mortality to the pilot whales, the California Department of Fish and Game and the National Marine Fisheries Service began a series of aerial surveys around Santa Catalina Island in December 1980 in order to determine the size of the seasonal population during the months of December-February and estimate the impact of any mortality on this population.

All flights were made using a twin-engine, high-winged Cessna 337 Skymaster owned and operated by the California Department of Fish and Game (CF&G), and piloted by a CFG warden/pilot. Two observers occupied the rear seats from which they searched a water surface area of one-eighth nautical mile at predetermined altitudes. Since the aircraft's landing wheels rested directly below the rear observational windows, the area directly below the plane was not viewed and the actual survey areas were offset from the plane's trackline over the water. A recorder occupied the front seat from which he monitored the aircraft's instrument panel.

Surveys were flown at altitudes between 500 and 700 feet, at ground speeds between 90 and 150 knots, during 0930-1530 hours local time. The pilot used a RNAV navigational system as the primary means of maintaining the repeatability of the planned tracklines. Before the December 1982 flights, a Texas Instruments airborne LORAN-C 9900 navigational system was installed. This device allowed the recorder to obtain the aircraft's position in latitude and longitude with .1 nautical mile accuracy at any time.

Surveying was conducted from December 20 to 21, 1984, around Santa Catalina and Santa Barbara Islands. Four additional days were flown during January 14-18, 1985, along Santa Catalina and San Clemente Islands and along the coast from Santa Barbara to Long Beach, California. The area in which these surveys were flown is shown in Figure 1, with the actual tracklines indicated for all flights during the period. The distribution of sightings is shown in Figure 2. Only three separate sightings of pilot whales were made totaling 58 individuals. Fifty of these animals were near Santa Catalina Island. No sightings of pilot whales were made during the 1983-1984 aerial surveys, in sharp contrast to the numerous sightings which occurred during both the 1980-1981 and 1982-1983 surveys. Oliver speculates that the recent El Niño event may have reduced the presence and spawning of market squid with a resulting effect on the presence of pilot whales in the areas surveyed.

Data were also collected on other marine mammal species observed during these surveys. There were 210 sightings distributed as follows:

Species (Common Name)	Number of Sightings	
	Dec. 1984	Jan. 1985
Common dolphin	8	10
Risso's dolphin	6	11
Pacific white-sided dolphin	0	8
Short-finned pilot whale	1	3
Dall's porpoise	0	1

Gray whale	2	29
Minke whale	0	1
Unidentified dolphin or porpoise	6	10
Unidentified small whale	0	2
Unidentified large whale	1	0
California sea lion	37	29
Northern elephant seal	6	1
Harbor seal	2	3
Unidentified pinniped	6	27
TOTALS	75	135

These data will be included in a report on the distribution and numbers of marine mammals observed during the aerial surveys conducted from December 1980 to January 1985. (Chuck Oliver, FTS 893-6288)

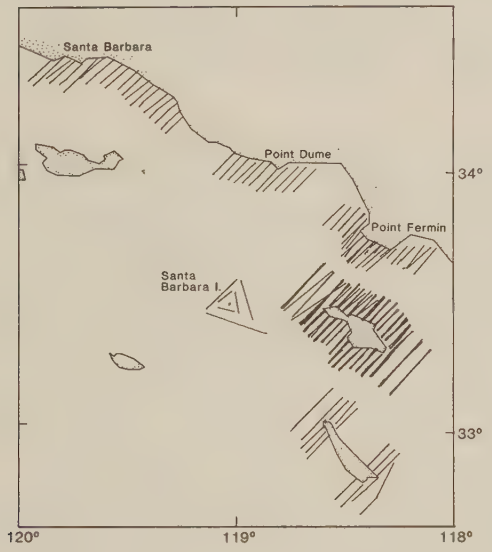


Figure 1. Tracklines flown during aerial surveys conducted December 20-21, 1984 and January 14-18, 1985 over the Southern California Bight.

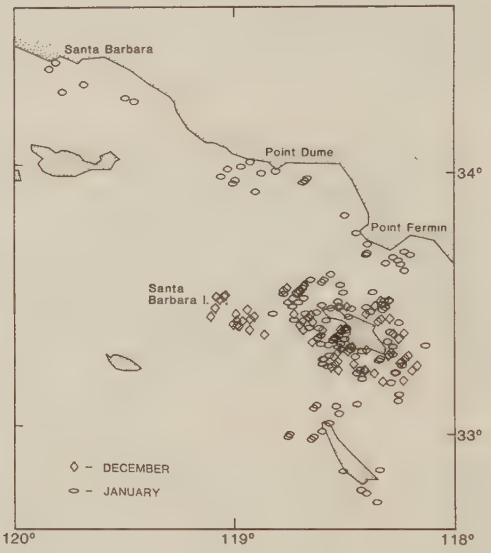


Figure 2. Distribution of all marine mammal sightings observed during aerial surveys conducted December 20-21, 1984 and January 14-18, 1985 over the Southern California Bight.

ECOLOGICAL AND FISHING SYSTEMS INVESTIGATIONS

Programs to Display Search Patterns of Tuna Vessels Developed

Dr. Tim Smith, Fishery Biologist, and Paul Robertson, Operations Research Analyst, have developed a series of computer programs designed to display graphically the search patterns of tuna vessels in the eastern tropical Pacific. This work is one phase of a larger research effort exploring the use of data collected by scientific technicians aboard tuna

purse seiners for assessing the relative abundance of the dolphins that are incidentally killed in some of the purse seine sets.

Smith and Robertson's work follows one of the directions suggested by Dr. Tom Polacheck in his Ph.D. dissertation at the University of Oregon. In his study, which he completed in 1983 while a SWFC employee, Polacheck noted that in 1979 most of the purse seine sets made by tuna vessels occurred in close proximity to each other in clusters of 3 to 30 sets. These clusters were separated from each other by relatively longer distances where searching was less successful. Smith and Robertson exploited this observation and simplified the complex data recorded by the scientific technicians, thus allowing effective graphic presentation of the search pattern of entire fishing trips.

These graphic displays are generated on an IBM-PC compatible microcomputer, using the built-in machine-dependent color graphics routines. A standard color monitor (690 by 240 pixel resolution) is used for the actual display. Many details about the fishing trip can be displayed along with the track between the actual sets by using different patterns of color. Versions of these programs have been developed which show, by color coding, the types of sets (school fish, log, and dolphin) made in the several segments of the fishing trip..

This approach can be extended to explore the implications of some other observations made by Polacheck. He suggested, based on examining data from 1979, that searching was not spatially random in most of the cruises, that the vessels tended to return to the area of previous sets, and that a large fraction of the searching occurred in a small fraction of the total area. To investigate the degree to which different vessels searched the same areas, Smith and Robertson modified the programs for plotting the search pattern for individual cruises to display contemporaneous portions of the tracklines of all vessels carrying scientific technicians.

These programs produce a moving image of the searching by the vessels, which can be enhanced to show ancillary information by color coding. Examination of the image generated for the data collected in 1979 suggests a high degree of overlap, with the areas of concentration moving markedly throughout the year. Such behavior would result in sample biases where certain areas are over-represented in the data collected by the scientific technicians.

The present programs are designed to use a minimal number of the variables in the detailed data collected by the scientific technicians. For the basic display only the location, date, and details about each set are required, although additional data about vessel movements and ancillary sightings allow more elaborate displays. There are two directions for extension of this approach. One is to apply the same procedure to the more extensive but less complete data that exist for nearly all of the fishing vessel trips. Comparisons of those data with the scientific technician data would allow appraisal of the representativeness of the scientific technician data, and would allow identification of the influence of the vessels which did not carry a scientific technician on the overall search pattern of the fleet.

A second direction to extend the graphic displays described here is to use the greater resolution available in the data recorded by the technicians to describe the path that the vessels searched in much greater detail than allowed by just considering the sets made. Comparison of more resolute displays of the data would allow a better evaluation of the degree of oversampling of areas.

At present only the data collected in 1979 have been examined using these programs. Further analysis of these data, including more critical evaluation of the details of the data for certain cruises, is planned. Additionally, these data will be used for other graphic displays involving more of the variables. Data from other years will be examined in the near future to determine the degree to which the patterns seen in 1979 data appear, and to look for expected differences associated with changing fishing patterns such as increased emphasis on school fish in some years. Also, these displays of the search patterns will be compared in years with different environmental features, such as the presence of the El Niño phenomena, to determine the effect of such changes on the search patterns, and hence on possible sampling biases that will have to be accounted for in order to use the tuna vessel data to monitor the abundance of dolphins. (T. Smith, FTS 893-8266)

BIOLOGICAL SYSTEMS INVESTIGATIONS

Albacore Studied

In a preliminary analysis of mitochondrial DNA (mtDNA) from 10 albacore caught off San Diego and 6 from Cape Town, South Africa, Dr. John Graves, Fishery Biologist, found that no significant nucleotide sequence differentiation was demonstrated between the mtDNAs of the fish from different ocean basins. At this time seven restriction endonucleases have been used to survey approximately 100 nucleotide base pairs, or approximately 0.7% of the mtDNA molecule. The final analysis, to be reported at the Albacore Workshop in May, should include the data from a survey of at least 250 base pairs. If the data remain consistent, they indicate significant gene flow between albacore of all ocean basins on an evolutionary time scale.

To determine the level of interspecific mtDNA sequence differentiation in marine fishes, as a basis to examine intraspecific differentiation, Graves has completed an analysis of three local species of basses in the genus Paralabrax (P. clathratus, P. maculatofasciatas and P. nebulifer). Almost 300 nucleotide base pairs of the three species have been surveyed with 15 restriction endonucleases. Results indicate nucleotide sequence divergences between the species of 3-5%. A tandem electrophoretic study of the three species by R. Waples of Scripps Institution of Oceanography produced consistent interspecific genetic relationships. However while only one of the 41 electrophoretic loci could distinguish all three Paralabrax species, 13 of the 15 restriction enzymes were able to distinguish all three species. (J. Graves, FTS 893-6213).

Stranded Gray Whale Calf Buried at Camp Pendleton

On January 28, Hannah Bernard, coordinator of the Southwest Fisheries Center's Marine Mammal Salvage Program, and biological technicians James Gilpatrick and Carrie Wilson responded to the first stranded whale of the year in San Diego County. The one- or two-month-old male gray whale calf (Eschrichtius robustus) washed in at the Del Mar boat basin of the U.S. Marine Corps base at Camp Pendleton, Oceanside, California.

The cause of the calf's death could have been fishery related. Monofilament fishing line was tangled around both flippers, extending across (and cutting) both eyes and into the whale's mouth. A mass of seaweed was found lodged in the whale's throat, held in place by the fishing line. It was not possible to perform a detailed necropsy or determine the exact cause of death because most of the whale's internal organs had already begun to autolyze by the time dissection was attempted.

Other organs were salvaged for use by scientific investigators. Dr. Kurt Benirschke, director of research for the San Diego Zoo, removed the cornea of the left eye for Ulfur Arnason, a genetics researcher at the University of Lund, Sweden. Dr. Eugene Perrin, faculty member at Wayne State University, assisted in removal of the heart for examination. The scientists also collected baleen and ecto-parasites and a patch of the whale's hair follicles for the SWFC's collection and Sea World's Education Department. Howard Braham, Director of the National Marine Mammal Laboratory, Seattle, Washington, requested photos and a copy of the data collected on the calf.

Slader Buck, Wildlife Biologist for Camp Pendleton, coordinated the assistance of enlisted personnel to bury the 5-meter whale for exhumation of the the skull and skeleton in one year for re-assembly and display (Figure 1). (H. Bernard, FTS 893-6369)

Figure 1. Marines assist Hannah Bernard and Slader Buck (on the right) in unloading gray whale calf for on-site burial at Camp Pendleton.

Production Analysis of Spinner mtDNA Completed

Fishery biologist Dr. Andrew Dizon reports the completion of the first phase of a study designed to investigate the relatedness of individuals from the eastern spinner and the whitebelly spinner stocks of Stenella longirostris. The technique relies on comparisons, between individuals, of restriction fragment length polymorphisms (RFLP's) in the mitochondrial DNA. The mtDNA of 75 samples cut with 7 restriction enzymes have now been prepared to the point where the RFLP's can be analyzed. By way of comparison, the relatedness of the human racial types were analyzed by RFLP patterns of mtDNA using 6 enzymes and 200 samples.

The production level of samples is now at the point where 90 samples can be analyzed with one restriction enzyme in one week. After the fragments are measured and analyzed, work will begin again if warranted, to analyze approximately two more groups of 75 samples each. The objective is to make meaningful comparisons between the radiation of human mtDNA types and those of Stenella longirostris. This, and information from extensive morphological studies, should assist managers in making decisions based upon the racial diversity of the porpoise stocks. (A. Dizon, FTS 893-6213)

Test Validates Age Estimating Method for Bottlenose Dolphins

Dr. Al Myrick, Wildlife Biologist, and Zoologist Aleta Hohn report the completion of a study in which dentinal growth layer group (GLG) patterns in teeth of captive dolphins were compared with the teeth of wild dolphins of the same species from the same general area. The research was conducted to test the validity of using GLG calibrations from captive specimens to estimate ages of wild specimens. The method has been questioned because it has not been known whether the conditions of captivity substantially alter GLG deposition rates or patterns. If deposition rates are different in captive animals, the criteria developed from captive studies cannot be reliably applied in estimating ages of wild specimens.

For their study, Myrick and Hohn used teeth from 13 known-age or minimum known-age wild bottlenose dolphins (Tursiops truncatus) and from 11 known-age and tetracycline-labeled bottlenose dolphins in captivity. The wild dolphins belong to a group of animals off the west coast of Florida that has been under close observation for about 15 years by Michael Scott, IATTC, Randall Wells, Dolphin Biology Research Associates, and Blair Irvine, University of Oregon. The identity, sex, relationship, and minimum age, or (for several animals whose births were documented) actual age of each specimen was known. Nine of the captive animals had been taken as display animals from U.S. Gulf Coast waters. Two were captive-born from Gulf Coast parents. All eleven were used in a 3 1/2-year experiment in which the water temperature, salinity, food intake, behavior, and handling had been recorded daily. During this period they were injected with labeling doses of tetracycline at approximately three-month intervals and a tooth was extracted from each animal at about 6-month intervals.

Annual dentinal GLG patterns and deposition rates were calibrated using the multiple, known-date tetracycline labels in the teeth pulled from the captive animals. Results of this calibration indicated that a GLG of a rather specific thickness was deposited in the tooth of each animal of a

given age. As a practical test, annual GLG patterns defined from the captive specimens were used to estimate the ages of the wild specimens. The investigators made their decisions without knowledge of the known ages of the wild specimens. The estimates made from GLG counts were found to be close to or the same as the ages known or estimated from field observations.

Myrick and Hohn concluded that captivity of northern Gulf Coast bottlenose dolphins does not appreciably affect GLG deposition rates or patterns and the criteria developed from the studies of captive animals may be used to estimate real ages of specimens from the wild population. An account of this work will be presented at the IV International Theriological Congress to be held in Edmonton, Alberta, Canada in August. (A. Myrick, FTS 893-6335)

MULTISPECIES DATA MANAGEMENT AND FISHERIES MONITORING

Status of Puerto Rico Sampling Program

Eugene Holzapfel, Biological Technician, continued to collect length-frequency samples of 1984 Atlantic and Indian Ocean tuna catches that are transshipped to Mayaquez, Puerto Rico. As of February 28, 1985, 99 samples (40 yellowfin tuna, 26 bigeye tuna, 29 skipjack tuna, 3 albacore and 1 little tunny) have been received that represent over 11,094 mt (91 samples, 5,086 fish) of Atlantic transshipments and 4,256 mt (8 samples, 327 fish) of Indian Ocean transshipments. All of the transshipments from the Indian Ocean are from purse seiners. Catches from the Atlantic are from purse seiners, baitboats and longliners. Sizes of fish caught in both oceans are similar, although Holzapfel reports that some very large yellowfin and bigeye tunas are being landed from Indian Ocean transshipments that could not be measured due to logistic constraints. (A. Coan, FTS 893-6377)

SENIOR SCIENTIST UNIT

Revision of Taxonomy of Spotted Dolphins Nears Completion

Dr. William F. Perrin, Senior Scientist, reports that data collection and analyses to revise the taxonomy of the spotted dolphins (Stenella spp.) have been completed and a manuscript is in preparation. The study, begun some 8 years ago, has been carried out in collaboration with several other systematists: J. G. Mead of the Smithsonian Institution, E. D. Mitchell of the Arctic Biological Station in Montreal, D. K. and M. C. Caldwell of the University of Florida, and P. J. H. van Bree of the Institute of Taxonomic Zoology, Amsterdam.

Two species of spotted dolphin inhabit the Atlantic. This became apparent during the 1970s, when many good photographs of live or freshly dead specimens became available. Both are spotted, but the color patterns are otherwise quite disparate. (The two species are excellently

illustrated in the recently published Sierra Club Handbook of Whales and Dolphins by Leatherwood, Reeves and Foster.) One form (which in the Pacific has been referred to as the nominal species Stenella attenuata) occurs around the world in tropical waters. The other form has been reported only from the Atlantic (Figure 1). Several names have been variously applied to spotted dolphins in the Atlantic in recent years. Of these, S. attenuata, S. plagiodon, S. frontalis and S. dubius, all described in the Nineteenth century, have had the most currency. The holotype specimens are skulls only, with no data on sex, external appearance or postcranial skeleton; some are from unknown localities.

Figure 1. Top three dolphins are the Atlantic endemic spotted dolphin. Bottom two dolphins are pantropical spotted dolphin.

The job of the group revising the spotted dolphins was to match up the holotype skulls with the two apparent species that exist in the world's oceans. They set out to solve the problem by assembling series of skulls from animals known to be of one or the other of the two apparent species, i.e., specimens for which the color pattern had been photographed or adequately described. The holotype skulls were then to be compared with these two series and the names sorted out. Unfortunately, it was soon discovered that both of the apparent species exhibit very great geographical variation in size and shape of the skull. In some regions, the endemic Atlantic species has a larger and broader skull than does the pantropical species; in other regions the relationship is reversed; in other regions, e.g. in the Caribbean, the two species converge in skull size and shape to a remarkable degree. Thus, identification of the holotype skulls became a complex task. Material from as many regions as possible had to be considered. The major collections of Atlantic spotted dolphin specimens are in the U.S. (Washington, New York and Boston), England, France, Denmark, and the Netherlands. Small numbers of specimens also exist in several other collections around the world. Collecting the data from this scattered material required several years of cooperative effort.

It was found that the two apparent species differ not only in color pattern but also in number of vertebrae: the Atlantic species has about 70 and the pantropical species about 80, with no overlap. This allowed augmentation of the two known-species series with specimens for which color pattern was unknown but vertebral count was recorded. Nonetheless, the sample size for Atlantic specimens of the pantropical species remained very small. A large series of skulls in the British Museum from St Helena were suspected to be of the pantropical species but remained unidentified. Perrin traveled to St Helena in 1983 (with funding from the National Geographic Society) to survey the dolphin fauna of the island and to interview the fishermen who had collected the skulls. He was able to determine that the skulls in the British Museum came from dolphins of the pantropical species. This meant that the samples from the two species were now large enough for comparative analysis.

The two series of skulls overlap in all characters, including numbers and size of teeth. Initial attempts to apply discriminant analysis failed due to violation of the assumption of multivariate normal distribution of character states within groups (because of geographical variation, the samples for both species each had polymodal distributions in all characters with any useful range of variation). Standardization of the characters (division by an overall length or width measure) improved the situation, but separation of the two groups was still incomplete, with the unidentified holotype skulls falling in the trough between the two modes. The project was stymied for some time, until a new character (a width measure involving the prenarial triangle on the rostrum) was discovered. This character in concert with the conventional set of characters separated the two series completely. This measurement was obtained for all of the material.

The holotype specimens have now been successfully assigned to the two species. The pantropical species remains <u>Stenella attenuata</u>, and the Atlantic endemic species becomes <u>S. frontalis</u> (with <u>S. plagiodon</u> in synonymy). The manuscript in preparation will present the analyses,

redescribe the species, and describe geographical variation in the Atlantic. The authors will submit an abstract to the Sixth Biennial Conference on the Biology of Marine Mammals to be held in Vancouver, British Columbia in November. Future efforts of the team will be directed toward elucidating distribution and variation of S. attenuata (and other small-cetacean species) in the central and western Pacific and the Indian Ocean. (W. Perrin, FTS 893-6267)

PACIFIC ENVIRONMENTAL GROUP
Monterey, California

Effects of Weather Conditions on Albacore Catch Rates Studied

Albacore fishing operations are subject to weather conditions. Oceanographer Paul Sund is interested in how variations in weather affect monthly and annual catch rates. He has been attempting to develop a wind-fishability index. Such an index could be used as input to albacore modeling studies to investigate the effects of the weather on the interpretation of catch-effort. Recently, Sund studied information provided by members of the Western Fishboat Owners Association (WFBOA) on windspeeds at which they stop fishing.

Sund found that larger vessels were able to fish in higher winds, although there was a high degree of variability. This variability is not unexpected because the estimates of windspeed are subjective (few boats have instruments to measure windspeed), and because the reports came from vessels of varying characteristics, construction and sea-keeping and from operators with varying tolerances to weather and sea condition.

Sund also found that there appeared to be about a five-knot difference in windspeeds at which operations were stopped, depending on whether the boats were engaged in fishing or not. A further five-knot difference occurred between the speed at which operations would stop while not fishing and the windspeed at which it was felt that no operations at all were possible.

The baitboat vessel length and windspeed relationship also showed that large boats can tolerate higher winds than can small ones. The baitboat reports received indicated that all fishing operations ceased at windspeeds of 35 knots. According to a linear model fitted to the data, a hypothetical baitboat of 56 feet (mean length of vessels reporting) stops fishing when encountering winds of about 25 knots. Few differences in the length-windspeed relationship were apparent between the northern and southern coastal areas fished by bait vessels. Jig fishing appeared unaffected by winds up to about 20 knots, and in a few cases fishing occurred in winds as high as 65 to 70 knots.

Overall, in the Northeast Pacific, winds above 30 knots occur only about 3% of the time, yet, if fishing truly were not affected by winds below 30, windspeed statistically would not be a significant factor limiting fishing. The general perception seems to be, however, that weather conditions do indeed sometimes significantly affect catch rates. To further investigate this apparent paradox, alternative data sources were obtained. These included charter fishing vessel day logs, the Navy climatic atlas, and climatologies of computed winds at times and places where fishing stopped. These sources indicate that winds can begin to affect fishing at speeds as low as 10 to 15 knots and that when winds reach 35 to 45 knots almost all fishing is stopped.

French Scientist Visits P.E.G.

Philippe Cury, ORSTOM (Overseas Scientific and Technical Research Office of the French Government) is visiting P.E.G. for several months. Cury is primarily working with Dr. Roy Mendelssohn on modeling environmental influences on sardine stocks in the Gulf of Guinea off the Ivory Coast and Ghana.

In some preliminary analyses already completed, Cury and Mendelssohn examined the behavior of SST along the coast, by 1° square. Cury and Mendelssohn found a regular propagation of sea surface temperature (SST) that would be consistent with a model of remote forcing in the area. Also, initial models of overall catch-per-unit effort (CPUE) for all pelagic species off of the Ivory Coast (but dominated by Sardinella maderensis) with SST and salinity show that at least 50%-60% of the variance of CPUE can be explained by the model. The most interesting feature of the model is a highly significant relationship between CPUE and SST from nine months earlier. Cury and Mendelssohn hope to refine this model, as well as to extend it to examine the relationships between CPUE, SST and salinity in time and space.

When Cury is finished at P.E.G., he plans to visit the Coastal Fisheries Resources Division in La Jolla to work with fishery biologist Dr. Alec MacCall. (Roy Mendelssohn, 408-646-3311)

IGOSS Meeting Held

The annual meeting of the U.S. participants in the Integrated Global Ocean Station System (IGOSS) was held. The meeting was hosted by PEG and the Fleet Numerical Oceanography Center (FNOC). The IGOSS program is an international program supported by the World Meteorological Organization and the Intergovernmental Oceanic Commission to increase the quantity and quality of marine environmental observations. This program stresses reporting of observations in real-time by radio and satellite communications.

Timely reporting of large numbers of high quality marine observations is necessary for mapping ocean fluctuations in support of fisheries-oceanographic research. Dr. Douglas McLain of PEG has been working closely with FNOC, National Weather Service, National Ocean Service, and other agencies for the past several years to try to improve the monitoring and reporting of marine data. At the meeting he described recent PEG/FNOC work, including 1) improvement of FNOC software for processing XBT data from ships of opportunity, 2) development of a system to read digital cassettes off XBT data from a microcomputer into FNOC's mainframe computers and to perform initial quality control procedures on the data, 3) development of software for digitizing XBT analog strip chart recordings using a microcomputer and digitizing tablet, and 4) improvement of software on the Naval Postgraduate School research vessel, Acania, to report observations in real-time via the GOES Satellite. Much of this work is being done by contractors with support from the National Climate Program Office and the Tropical Ocean-Global Atmosphere Research Program (TOGA). (Douglas McLain, 408-646-3311)

TIBURON LABORATORY
Tiburon, California

GROUNDFISH ANALYSIS INVESTIGATION

Third Western Groundfish Conference Hosted by Tiburon Laboratory

The Third Western Groundfish Conference, co-hosted by the Northwest and Alaska Fisheries Center and the Southwest Fisheries Center's Tiburon Laboratory, was held in February 1985 in Union, Washington. This conference was dedicated to an understanding of the multispecies-multifishery interactions of the Pacific West Coast's most valuable fishery. The format which features presentations of completed, ongoing and proposed groundfish research has resulted in early dissemination of new theories and fresh ideas concerning all aspects of the West Coast groundfish fishery.

This year Edward Ueber, Economist at the Tiburon Laboratory, and Dr. Robert Francis, Fishery Biologist with the Northwest and Alaska Fisheries Center, jointly chaired the largest conference yet held. More than 60 people from these two research centers constituted the bulk of the participants with other participants attending from 10 states, and nearly 25 different entities and groups, including private citizens, consultants, federal agencies, state agencies, interstate and international compacts, and 10 universities.

Some of the Southwest Fisheries Center's staff who participated in the Western Groundfish Conference. From the left: Tony Chess, Ted Hobson, Mike Bowers, Izadore Barrett, Norm Abramson, Maxwell Eldridge, Ed Ueber, Pete Adams, Bruce MacFarlane, Sharon Moreland, Tina Wyllie Echeverria, George Boehlert, and John Carr.

Fisheries economics and management were the special topics of the 1985 conference. The highlight of the special session was the panel discussion on alternative tools for managing the groundfish fishery. Other presentations were on such topics as juvenile fish stock assessment, effects of El Niño, cannibalism in walleye pollock, indirect ageing methods, and other pertinent areas of groundfish research. Poster sessions were also presented on walleye pollock, rockfish and patterns of fish year-class strength.

To encourage further broadening and wider participation, next year's Groundfish Conference will be hosted by Alaska Sea Grant and co-chaired by persons outside the NMFS. (William Lenarz, FTS 556-0565)

Juvenile Rockfish Identification Progresses

On February 19, Wayne LaRoche visited the Tiburon Laboratory to examine specimens of juvenile rockfish identified by biological technician Sharon Moreland. LaRoche is working under contract to the Southwest Fisheries Center and Northwest and Alaska Fisheries Center to develop an illustrated guide for identification of juvenile rockfish. Moreland's collection of identified specimens contained 10 species that were needed to illustrate the guide.

The two researchers also compared an Oregon specimen identified by LaRoche as Sebastes chlorostictus with a specimen from central California identified by Moreland as either S. chlorostictus or S. rosaceus. Both species are from the Sebastomus group. Methods for identification of juveniles of species of the group have not been thoroughly developed. The California specimen is definitely a different species from the Oregon specimen, and the specimens will prove useful in further development of identification methods. (William Lenarz, FTS 556-0565)

Central California Fixed-Net Fishery Investigated

Edward Ueber, Industry Economist in the Groundfish Analysis Investigation, Constance Ryan, Bay Area Sea Grant Advisor, and Paul Wild of the California Department of Fish and Game (CDF&G), are working on an economic, safety and structural survey of local, fixed-net fishermen. The study is designed to determine fleet size, fishing strategies, employment characteristics, and the economic effect on the local community. The study will cover 1984 and will be correlated with the ongoing CDF&G biological evaluation of these fixed-net fisheries.

The area of investigation is from Monterey Bay to Bodega Bay and will cover gill, trammel, and suspended gill nets. Preliminary contact has been made and it appears that traditional trammel-net fishermen are willing to cooperate. Rockfish gillnetters will be asked to participate as soon as an adequate means of communication is established. The majority of rockfish gillnetters speak only Vietnamese, so translators may be needed if the current method of using translated interview forms does not work. (Edward Ueber, FTS 556-0565)

GAM Formed to Assist Economists

In October of 1984, a Working Group of economists was established to evaluate alternative methods of management for West Coast groundfish. The economists who make up the group are from private and state universities and the National Marine Fisheries Service (NMFS). Dr. Daniel Huppert of the La Jolla Laboratory heads this Working Group.

A Groundfish Alternative Management (GAM) group is being formed, with Edward Ueber as the chairman, to provide groundfish fishery expertise to the Working Group. GAM will be composed of groundfish fishermen, processors, and knowledgeable representatives of state agencies. Ueber recently traveled from San Francisco to Hoquiam, Washington, to gather names of fishery experts and interview prospective members for GAM. A joint Working Group/GAM meeting is planned for late March 1985. Both groups are scheduled to function for two to three years. (Edward Ueber, FTS 556-0565)

PHYSIOLOGICAL ECOLOGY INVESTIGATION

New Research Program Begins on the Physiological Ecology of Groundfish

Research of the Tiburon Laboratory Physiological Ecology Investigation examines the functional relationships between fishes and their host environments. This approach is now being directed at the Pacific groundfish fishery and the need for relevant biological information for managing the fishery along the northern California coast. The new Physiological Ecology of Pacific Groundfish Task consists of multidisciplinary, integrated studies designed to determine the inherent and environmental factors that most affect reproduction and health conditions in important groundfish populations (Figure 1). The goal is to assess the status of stocks and to forecast recruitment from one year to the next in various groundfish populations. Research consists of comprehensive laboratory examinations and analyses of adult and juvenile specimens collected from the commercial and sport groundfish fleets and from cruises aboard the NOAA Ship David Starr Jordan. Initial efforts are focused on four important rockfish species (Sebastes paucispinis, S. goodei, S. entomelas, and S. flavidus). Scientific information from laboratory analyses and from later laboratory experiments will be used to describe and determine important aspects of reproduction and biological conditions which are used as relative measures of health and viability. These efforts include such activities as proximate analyses of tissues, estimates of viable fecundity and egg resorption, examinations for diseases, parasites and malformations, and determination of gonadal steroid cycles. The demonstrated performances of groundfish populations will be combined with oceanographic and other environmental data in order to place the species and their populations in the context of their habitats and varying environmental conditions. These processes will be compared with research findings in related tasks within the Tiburon Laboratory and Southwest Fisheries Center to develop both conceptual and empirical models

on predicting recruitment variability and determining the relative conditions of different statuses. (Mickey Eldridge, FTS 556-0565)

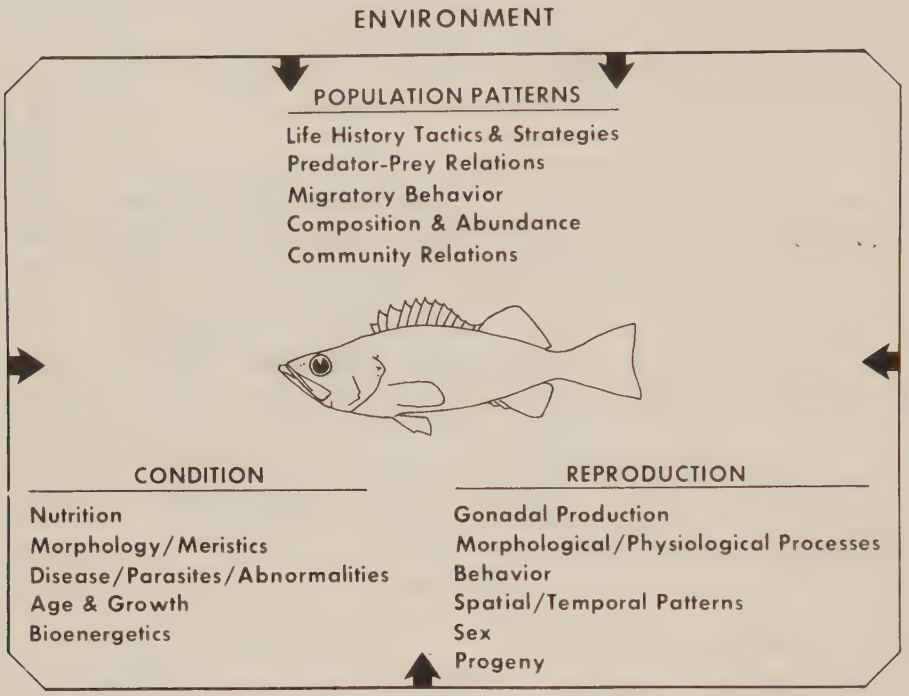


Figure 1. Conceptual model illustrating the multifaceted components of the new task on the physiological ecology of groundfishes.

FISH COMMUNITIES INVESTIGATION

Harvesting Sexually Segregated Populations of Lingcod Studied

In preparation for a stock assessment document on lingcod (Ophiodon elongatus) for the Pacific Fishery Management Council Groundfish Management Team, fishery biologist Peter Adams found evidence that lingcod populations are sexually segregated. Lingcod has a very complicated life history because of an elaborate reproductive system based on nesting and male nest-guarding behavior. Catch statistics show that the more inshore recreational catch has a sex ratio of approximately 1 male to 0.43 females, although the more offshore commercial catch has the reverse sex ratio of approximately 1 male to 2.33 females. This is strong evidence for some degree of year-round segregation of male and female lingcod by depth.

In order to evaluate the impact of harvesting a sexually segregated population, a simple model was constructed where 1,000 recruits enter the cohort at age 1 with a 1:1 sex ratio. These recruits were divided equally into two populations: 1) an inshore recreational population with a sex ratio of 1 male to 0.43 females and a fishing mortality of 0.2, which corresponds to the level of recreational fishing, and 2) an offshore

commercial population with a sex ratio of 1 male to 2.33 females and a fishing mortality of 0.7, which corresponds to the level of commercial fishing. Both populations are subject to a natural mortality of 0.2. The result of this type of model was a standing population with a sex ratio of sexually mature fish of 1 male to 0.32 females. Because of the parental care/nesting systems of reproduction, any deviation from a 1:1 sex ratio represents surplus population from a reproductive standpoint. This means that under these circumstances one-half of the population is not involved in reproduction. (Peter Adams, FTS 556-0565)

UNDERUTILIZED FISHERIES RESOURCES INVESTIGATION

Local Fisheries Development Projects Show Progress

Fifty tons of shortbelly rockfish were landed in Monterey and sold to a pet-food maker in Los Angeles. According to task leader Sus Kato, a second processor in Monterey has a market order for several tons of shortbelly rockfish for use as food, and he will try to fill that order after the spawning season when the quality of the fish is better.

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A rock crab fishery has been started in Eureka with the aid of Investigation personnel and the local Sea Grant Marine Advisor. Markets have been located in San Francisco, Stockton, and Sacramento and although the demand is still small, the prospects of growth are good.

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A Monterey fisherman will soon receive a permit from the California Department of Fish and Game to fish for euphausiids. The fisherman will participate in a joint study with members of the Underutilized Fisheries Task to study distribution and availability of two species of euphausiids. Two local public aquaria have placed orders for a few hundred pounds of frozen euphausiids, and it is likely that a substantial market exists in the U.S. aquarium fish-food trade.

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Two fishermen in Eureka and Morro Bay are presently conducting experimental fishing trials for spot prawn, using traps that they borrowed from the Staff of the Underutilized Fisheries Task. Although catches have been low, the fishermen are expected to continue fishing periodically, hoping to find concentrations high enough to support commercial fishing.

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A potential market has been found for small flatfish that are presently being discarded from trawl catches. The fish will be gutted, salted, partially dried, and sold domestically and overseas. A Fort Bragg fisherman is providing samples for test processing and marketing.

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Staff of the Underutilized Fisheries task participated in a study funded by a Saltonstall-Kennedy grant to find alternative markets for albacore. Staff members arranged for a sushi shop in San Diego and a traditional fish restaurant in San Francisco to try frozen albacore. According to operators of both restaurants, the meat of frozen albacore was too soft and unappealing when compared with fresh yellowfin and bigeye tuna. The San Francisco restaurant would certainly welcome fresh albacore, but the sushi restaurant owner doubted that he could use albacore regularly (cost may have been a factor in his conclusion).

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"Guide to the Underutilized Species of California" has been reprinted, and four more species added. The additional copies were mailed to industry members, and updated sections were sent out to previous recipients of the Guide. (Sus Kato, FTS 556-0565)

FISHERIES INFORMATION SYSTEMS & ADP

Communication Plan for Financial Reporting System Established

Fred Kellenberger, Data Systems Manager, Jack Brown, Electronics Engineer, Rob Bistodeau, Computer Programmer, and Dorothy Roll, Computer System Analyst, formulated a communication plan for the Financial Reporting System (FRS) on the Molecular. In formulating the plan, they took into consideration hardware constraints, security of files, and communication cost. Jack Brown has completed the communication link for the La Jolla Laboratory's Molecular. Using this link, Rob Bistodeau has transferred the FRS commitment files from the Molecular in Honolulu to the La Jolla's Molecular. The test to transfer by using RModem, unattended service protocol, at one site and Modem7 at the other site failed. Bistodeau will discuss this problem with a specialist in DSI, the maintenance vendor. (Fred Kellenberger, FTS 893-6341)

Progress Meeting Held on CalCOFI Data System

Fred Kellenberger, Rich Charter, CalCOFI Data Manager, Larry Zins, Computer Programmer, and Dorothy Roll, CalCOFI System Analyst, met with Izadore Barrett, John Carr, and Reuben Lasker on February 27 to discuss the CalCOFI Data Management System. Charter, Roll and Kellenberger presented status reports. Significant progress has been made since the CalCOFI Workshop in September. The programs for preliminary edits, final edits, and data validation were written, tested, and installed. The Other Fish Larval data sets (for fish other than anchovy, sardine, saury, and round herring) from 1954 to 1969 have been entered on the UCSD VAX host computer. The fish identification specialists in Dr. Geoffrey Moser's group have completed the preliminary edits and final edits of the data for these years, and are now validating the data sets for 1954 to 1960. Seventy-five percent of the 1951 to 1953 data series have been keyed from the original source sheets to disk files. (Dorothy Roll, FTS 893-6250)

Files between Non-Compatible Microcomputers Transferred

During the past two months ADP Operations staff have assisted the Center's users in transferring text and data files between different non-compatible microcomputers.

Rob Bistodeau and Jerry Hornof, Computer Specialist at SWR, have transferred WordStar files between the LJ Standard micro and the Region's IBM PC. They are using XTALK, a communication software, for the transfer. Bistodeau and Susan Chivers, Computer Programmer in OFRD, have transferred data files from UCSD's VAX system to the SAGE computer in OFRD. The files were transferred from a VAX tape to the hard disk on the Molecular and from the Molecular to the SAGE system through Modem7 on the Molecular and LModem on the SAGE. With the assistance of Rich Charter, data files for Pierre

Kleiber, OFRD, were transferred from a LJ Standard micro diskette onto a diskette on the DEC RAINBOW 100 microunit. The LJ Standard unit was cabled directly to the RAINBOW and the transfer process was through KERMIT. (Dorothy Roll, FTS 893-6250)

UCSD Chosen as Site for Supercomputer

University of California, San Diego, has been selected as the site of one of four national supercomputer centers by the National Science Foundation. Fred Kellenberger participated in a consortium of 18 agencies and universities in the development of the grant proposal that was submitted to NSF. The four sites chosen for supercomputers were University of California, San Diego, Princeton University, University of Illinois, and Cornell University. The supercomputer Center is estimated to cost $100 million over 5 years, and it will be operated by G.A. Technologies, Inc. The CRAY X-MP/48 will be the central computer. It can calculate 2 billion characters per second and has the capacity to create three dimensional graphics. Researchers at the SWFC will be able to use the supercomputer at little or no expense to assist them on fishery research projects. (Fred Kellenberger, FTS 893-6341)

IBM Computers at the SWR Implemented

IBM AT systems have been installed for each division in the Regional Headquarters at Terminal Island. These include Management, Enforcement, Development and Administration. The four systems are equipped with word processing, database management, spreadsheet, and communications software. The communications software allows for data transfers with other AT systems, other IBM or IBM compatible systems, and the La Jolla Standard Systems. Additionally, an IBM PC system located at Terminal Island is fully compatible with NBI word processors, series 3000 and above.

Jerry Hornof, Systems Analyst, installed IBM PC systems at the Tiburon, Santa Rosa, and San Diego Regional Offices. Each site has a software complement similar to the AT systems described above. The communications capability allows for data transfers with the Regional Office at Terminal Island.

Computer consultant Norm Sondak gave staff training on the IBM systems from January 27 to 31 at the Regional Office. The first day focused on training for managers and professionals. The second two days were used to instruct the clerical staff on WordStar (word processing). Sondak will return in March to teach an advanced WordStar training class. Regional staff at the Tiburon and Santa Rosa Office also attended WordStar training classes for the SWFC Tiburon Laboratory. (Jerry Hornof, FTS 796-2878)

Telephone System Studied

The telephone system at the La Jolla Laboratory does not have the capacity to meet the Laboratory's demands for either voice or data transmission cost effectively. There are several alternative systems which employ more recent technology that will be cheaper and more effective.

Fred Kellenberger has developed a draft Request for Proposal to replace the current system. The new system would be an integrated voice/data system supplied by a reliable vendor that will provide both management and technical enhancements to our current service. The system should cut costs to the Laboratory by: 1) improving voice and data telecommunications services; 2) increasing staff productivity by reducing lost time in securing voice connections and in call back situations; 3) reducing the need for modems and separate data lines by supplying integrated voice/data transmission; 4) providing detailed management reports on system usage and applications for cost control and planning purposes. (Fred Kellenberger, FTS 893-6341)

Work Continues on Upgrading WPACFIN

David C. Hamm, Computer Systems Analyst, has completed and released an Administrative Report on WPACFIN progress and status as of January 1985. Data for 1984 were received for most databases maintained by WPACFIN. Several systems development and update efforts were also completed. Databases were updated with 1984 data received from American Samoa, Guam, and Commonwealth of the northern Mariana Islands. An assembly language utility program was developed and implemented to facilitate file management on the Honolulu Laboratory central computer. Another utility program was written and implemented to facilitate easy transfer of Apple-based data files to the dBase II files in the Molecular. A second Apple IIe microcomputer was added to the WPACFIN office and wired to the Molecular to handle all data transfer activities.

Ray Tulafono is the new Acting Chief of the Office of Marine Resources (OMR), Government of American Samoa. Tulafono was previously second in command at OMR and has been very supportive of WPACFIN activities. A new chief fishery biologist Raymond Buckley, who was formerly with the Washington Department of Fish and Game, joined OMR. (David Hamm, 808-943-1221)

Fisheries Managers from Federated States of Micronesia Visit Honolulu Laboratory

The Honolulu Laboratory hosted a meeting for the Federated States of Micronesia (FSM) fisheries agencies in February. Hamm represented the Laboratory at the meeting and briefed the participants on the basic design and philosophy of WPACFIN. The FSM fisheries agencies are trying to establish data collecting and processing systems to manage their coastal resources and to document development of their fisheries. (Dave Hamm, 808-943-1221)

ADMINISTRATIVE ACTIVITIES

Update of A-76 Study

The SWFC A-76 study has been at a standstill since November 20, 1984, when associate administrator William Gordon wrote to NOAA that the Arthur Young Management Efficiency Study (MES), "does not form an adequate foundation for proceeding further with the A-76 study." He also accepted Mr. Winchester's offer to complete the MES and subsequent work phases in-house. The government is conducting the A-76 study to determine whether costs for ADP services can be reduced by contracting out the work.

On January 15, 1985, Ralph Conlin, NOAA Contracts Officer, notified the Center that Arthur Young and Co. had complied with the terms of the Task Order, and that final payment is due for the work performed on the MES. Costs billable by Arthur Young and Company for the MES (phase I) are $52,603. Conlin has also initiated action to cancel the remaining work (phases II, and III) under the Task Order.

A NOAA team under the direction of Dean Brinker will complete the MES (phase I). Brinker is currently reviewing and supplementing the Arthur Young and Co. MES for the Southeast Fisheries Center, and he is expected to begin work at the Southwest Fisheries Center in May 1985. It is estimated that Brinker's work on the Southwest Fisheries Center's A-76 study will take about six months.

On February 12, 1985, Darrell Tidwell of the Southeast Center visited La Jolla Laboratory to discuss the A-76 review at the Southwest Fisheries Center which is being conducted by Brinker. (Benjamin Remington, FTS 893-6248)

MISCELLANEOUS

PUBLIC AFFAIRS

Honolulu Laboratory

February 14 - At the invitation of Dr. Dayton L. Alverson, Natural Resources Consultants, Seattle, Washington, Richard Shomura provided an update on Hawaiian fishery development to members of the Highliners Association at their annual meeting held on Kauai.

La Jolla Laboratory

On February 21, Dr. Albert Myrick spoke on "Marine Mammals of the Pacific" to students at Hoover High School.

SWFC Participates in Homeport San Diego Festival

The National Marine Fisheries Service's Southwest Fisheries Center and the NOAA Ship David Starr Jordan, participated in the Homeport San Diego Festival. The festival was held on January 12, 1985, at the San Diego, California waterfront in conjunction with the Year of the Ocean. An estimated 900,000 people attended the all-day affair which featured ocean exhibits, seafood festival, outrigger canoe races, sand sculptures, open house aboard Navy ships, U.S. Marine Corps bands and fireworks. William Gordon, Assistant Administrator for Fisheries, NMFS, Washington, DC, was an invited guest speaker. From the Southwest Fisheries Center, Dr. Richard Methot and Ken Raymond were hosts at an exhibit which depicted the variety of research conducted at the Center. The 171-foot Jordan, docked at a nearby pier, was open to visitors who saw a variety of exhibits on the open deck of the ship. Nelson Ross of NOAA's National Oceanographic Data Center also manned an exhibit at the Festival.

Richard Methot explains work done at the SWFC.

Visitors taking a tour of NOAA Ship David Starr Jordan

Tiburon Laboratory

On February 22, fishery biologist Mickey Eldridge lectured to a visiting graduate class from Humboldt State University on different research approaches to the study of environmental effects. A tour of the Tiburon Laboratory was given after the presentation.

SEMINARS

Honolulu Laboratory

January 18 - Drs. Skillman and Boehlert discussed current activities and future directions in their respective research programs.

29 - Dr. John Sibert of the South Pacific Commission, Noumea, New Caledonia, spoke on tag attrition models.

February 13 - Dr. Wetherall presented an overview of the Pelagic Stock Assessment Program and John R. Henderson, Fishery Biologist, an overview of the Marine Mammal and Endangered Species Program.

20 - Dr. David Jones, Professor of Zoology, University of British Columbia, Vancouver, Canada, spoke on "Tuna Blood--The True Story."

La Jolla Laboratory

January 10 - Dr. J.M. Stretta, Centre de Recherches Oceanographiques, Abidjan, Ivory Coast, gave a seminar on "Status of research on tropical Atlantic tunas at the Centre de Recherches Oceanographique, Abidjan."

15 - Dr. Richard W. Eppley, Phytoplankton Physiologist, Scripps Institution of Oceanography, spoke on "Use of satellite chlorophyll for estimating primary production."

25 - Dr. Michael Walker, National Research Council Fellow, Southwest Fisheries Center, presented a seminar, "Tuna navigation is a magnetic field of research: Magnetic sensitivity in the yellowfin tuna and possible magnetic navigation in tunas and whales."

29 - Louis Botsford, Population Dynamicist, University of California at Davis, gave a talk on, "Recruitment in Dungeness crab: Density dependence and/or environmental forcing."

February 4 - Jean Michalski, Technical Writer and Editor, Southwest Fisheries Center, gave a seminar on "Writing Effectively."

5 - Dr. Eugene V. Perrin, Professor of Pathology, Pediatrics, Obstetrics, Anatomy, and Anthropology, Wayne State University, spoke on "Monstrous dolphins."

6 - Arild Folkvord, Institute of Marine Research, Norway, gave a presentation on "Size specific vulnerability of northern anchovy (Engraulis mordax) larvae to predation by fishes."

8 - Dr. Alan R. Longhurst, Director-General, Bedford Institute of Oceanography, gave a seminar on "Research at the Bedford Institute of Oceanography."

19 - Dr. Dale Squires, Industry Economist, Southwest Fisheries Center, spoke on "Fishing effort: An economist's view."

28 - Professor James F. Kitchell, Ecologist, University of Wisconsin, spoke on "Predator-prey systems in the Great Lakes."

Pacific Environmental Group

January 16 - Marc Mangel, Department of Math at UC Davis, presented a seminar for the staff at PEG and other interested individuals on, "Stock assessment in aggregating fisheries."

HONORS AND AWARDS

Honolulu Laboratory

January 10 - Laboratory Director Richard S. Shomura presented length-of-service pins to Marian Yong (20 years), and Dr. Robert A. Skillman (15 years).

February 20 - Center Director Barrett presented belated length-of-service pins to the following employees: Carole A. Yukihiro (30 years), Joseph T. Arakawa (25 years), Dorothy D. Powell (25 years), Sally H. Kuba (20 years), Ray F. Sumida (20 years), Lucille T. Tsukano (20 years), and James H. Uchiyama (20 years).

Tiburon Laboratory

On January 25, in awards ceremonies of the Combined Federal Campaign at the San Francisco Presidio Officers' Club, the Tiburon Laboratory was presented Gold and Merit Awards for its generous donations. The Laboratory placed second in its size division in the San Francisco Bay Area campaign.

Administrative officer Walburga Giguere, accompanied by laboratory campaign chairman Pete Benville, accepted the awards on behalf of the Laboratory.

VISITORS

Honolulu Laboratory

January 15 - Stephen Nelson, University of Guam Marine Laboratory, Mangilao, Guam; Barry D. Smith, Sea Grant Extension, University of Guam; Kenneth Filak, Pohnpei, Kolonia, Federated States of Micronesia.

23 - Dr. Arthur J. West of Suffolk University, Boston, Massachusetts, visited Richard Shomura to discuss NMFS-UH interaction.

- Dr. Edward Houde, National Science Foundation visited Richard Shomura and Dr. Boehlert.

28 - Dr. Y. Watanabe, Tohoku Regional Fisheries Laboratory, M. Shimizu, Hokkaido University Faculty of Fisheries, and M. Kusakari, Hokkaido Institute of Mariculture, visited Dr. Boehlert to discuss research on Sebastes.

- Dr. John Sibert, South Pacific Commission, visited the Laboratory and met with Richard Shomura, Dr. Wetherall, and Dr. Gerrodette.

- Robert Worthington, Cook Islands Consul, Hawaii, escorted the Honorable Pupuke Robati, Minister of Marine Resources, Cook Islands, and Pamani Tangata of Rarontonga to meet with Richard Shomura.

January 28-February 10 - Akihiko Ebisawa, Okinawa Prefectural Fish Experiment Station, Itoman, Okinawa, Japan, spent 2 weeks at the Honolulu Laboratory working with Drs. Ralston, Polovina, Wetherall, and Skillman on resource assessment and population dynamics methods.

February 7 - Jay Hebert, Captain and owner of the lobster fishing boat, Lusty, met with Richard Shomura, Dr. Skillman, and Ray Sumida to discuss problems in fishery.

8 - Kenneth Osborn of AID, Washington, DC, visited Richard Shomura.

12 - Emma M. Escover of ICLARM, Philippines.

15 - Dr. David Jones, University of British Columbia, and Dr. Brill met with Richard Shomura.

16 - Bill Nelson, Seattle, Washington, Dr. Alexander Malahoff, HURL, University of Hawaii, Manoa.

22 - Anson Chong, Economic Development Division, and John B. Iou, Marine Resources Division, Yap, Federated States of Micronesia (FSM); "Reb" Rebeuluch, Yap Fishing Authority, Colonia, Yap; Mike Gawai, Chief of Marine Resources, FSM National Government, Pohnpei, FSM; Mike White, Chief, Marine Resources, Kosrae; Peter J. Rappa, Sea Grant College Program, UH Manoa; Jack Fisher, Department of Botany, UH, Manoa.

27 - Robert Henderson, Chief, Procurement Division, WASC, Seattle, Washington, met with Richard Shomura to discuss procurement concerns.

- Keichi Onishi, Fisheries Experimental Station, Izu Branch, and Fumio Tahara, Shizuoka Prefectural Office (Fisheries), Shizuoka, Japan.

La Jolla Laboratory

January 14 - Linda Koontz and Mark Evans, Government Accounting Office, Washington, DC, visited the lab.

16 - Drs. Joseph Angelovic and Richard Roe, Washington, DC, and Gary Smith, Southwest Regional Office Terminal Island, California, were at the Center for the porpoise/tuna monitoring meeting.

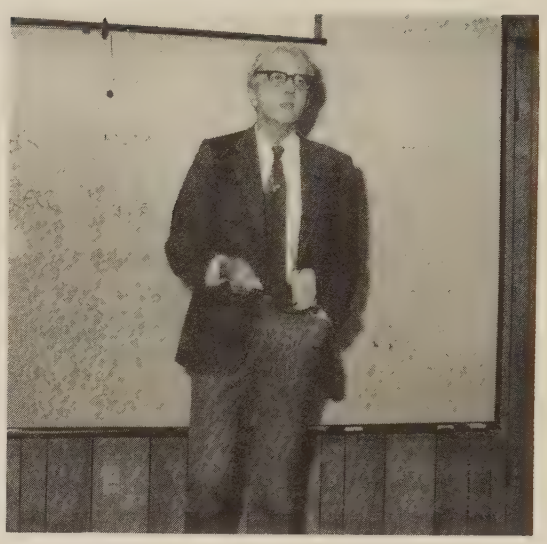
- Gerald Barton, NOAA, Washington, DC, visited the Center to discuss the MEDRES system.

18 - Dr. Jose Antonio Carranza, Director General, Instituto Nacional de Pesca, Mexico City, met with Izadore Barrett and Reuben Lasker.

- CMDR Walt Simmons, Chief of Commissioned Personnel, NOAA Corps, and LCDR Evelyn Fields, Rockville, Maryland, for discussions with Director Barrett.

29 - Ben Drucker, Washington, DC, met with Dr. Gary Sakagawa.

February 7-8 - Dr. Alan R. Longhurst, Director-General, Fisheries and Oceans, Bedford Institute of Oceanography, Halifax, Nova Scotia, visited the Center. Longhurst was Director of the Southwest Fisheries Center from 1972-1975. At right, Longhurst discusses organization of the Bedford Institute.



February 25-27 - Dr. Alexander Christakis, Director, Center for Interactive Management, George Mason University, Fairfax, Virginia, visited the Center.

Pacific Environmental Group

January 8 - Jim Hardwick and Bob Leos of California Department of Fish and Game met with Jerry Norton of PEG and discussed the effect of major environmental signals on local fisheries.

10 - Bob McAllister of California Department of Fish and Game met with Donna Mallicoate to discuss computer graphics programs for plotting rockfish data.

13 - Philippe Cury, ORSTROM, France arrived at PEG where he will work for 6 months with Dr. Roy Mendelssohn.

16-17 - Paul Kaufman, Carl Rubbo and Joyce Hall of the Office of the Inspector General visited PEG.

February 6 - Dr. William J. Richards of the Miami Laboratory SEFC/NMFS visited PEG to discuss editorial matters with staff.

Tiburon Laboratory

January 11 - Robert Henderson, Chief of Procurement, WASC, Seattle, Washington for a limited review of procurement operations.

14 - Dorothy Lowman, Pacific Fishery Management Council, Portland, Oregon, met with Ed Ueber.

16 - Fred Kellenberger, Data Systems Manager, Southwest Fisheries Center, met with Nancy Wiley.

18 - Rob Wolotira, Northwest and Alaska Fisheries Center, met with Norman Abramson.

- David Ainley and Susan Sanders, Point Reyes Bird Observatory, met with Pete Adams to discuss their participation in research cruises.

28 - Pete Kondrashoff, Fishermen's Marketing Association, San Francisco, California, met with Ed Ueber.

30 - George Trumbo, F/V La Tica, Harbor, Oregon, and Jim Whitsett, F/V Kara J., Brookings, Oregon, met with Sus Kato.

February 1 - Svein Fougner, Southwest Region, and Frank Henry and Mel Odemar, California Department of Fish and Game, met with Bill Lenarz, Candis Cooperrider, and Norman Abramson to discuss and outline various options for sampling California groundfish landings.

MEETINGS AND TRAVEL

Honolulu Laboratory

January 10 - Richard Shomura called a general staff meeting to speak briefly about the Honolulu Laboratory's budget and research for the coming year.

16 - Dr. Boehlert participated in the scientific review of the NOAA-University of Hawaii Joint Institute for Marine and Atmospheric Studies.

16-18 - Richard Shomura and Boehlert participated in the University of Hawaii Sea Grant Program Site Review.

17 - Sam Pooley attended the Pacific Islands Development Program briefing at the East-West Center.

21-24 - Richard Shomura, Boehlert, and Dr. Brill attended the Hawaiian Ocean Experiment planning workshop.

January 28-February 6 - Richard Shomura traveled to Seattle, Washington, (1/29-2/1) to conduct a close-out meeting with the Steering Group and session chairmen of the workshop on Fate and Impact of Marine Debris, and to La Jolla (2/4-5) to attend the Center Management Meeting.

January 29-February 16 - Dr. Boehlert traveled to Newport, Oregon, where he worked with Japanese scientists and others at the Cooperative Institute for Marine Resources Studies, Oregon State

University, on Sebastes reproduction. He also attended the Western Groundfish Conference, where he presented two papers, "Reproduction and embryonic energetics in the Genus Sebastes with a comparison of eastern and western Pacific species," and "Groundfish fisheries of the central North Pacific seamounts." The latter paper was co-authored with Dr. Wetherall. Boehlert also spent 2 days in La Jolla, California, to confer with Dave Mackett on plans for the seamount planning workshop that will be held in March.

February 18-19 - Richard Shomura, Dr. Skillman, and Sam Pooley participated in the Western Pacific Regional Fishery Management Council's Scientific and Statistical Comittee meeting in the Honolulu Laboratory conference room.

20 - Center Director Barrett spoke to the Honolulu Laboratory staff at a general staff meeting.

20-23 - Richard Shomura and Dr. Barrett traveled to Hilo, Hawaii, to participate in the 48th Council meeting.

25-26 - Richard Shomura attended the Pacific Fisheries Development Foundation meeting at the East-West Center.

26 - Richard Shomura met with Robin Tuttle and Dr. Gerald Posner from Washington, DC, and Peter Milone, Western Pacific Program Office, SWR, to discuss a study trip to the Marshall Islands.

La Jolla Laboratory

January 7-8 - Jean Michalski and Rob Bistodeau traveled to Terminal Island, California, to attend a meeting on Management by Objective Automated Tracking System.

7-9 - A Workshop on Oceanographic Models of Tuna Movements was held.

8 - Dave Mackett and John Carr traveled to Terminal Island, California, to attend a meeting on Management by Objective Automated Tracking System.

9-11 - Gary Sakagawa participated in a NMFS planning meeting for ICCAT bluefin tuna issues in Washington, DC.

11-14 - Jeanne Wexler traveled to San Clemente Island, California, to obtain monthly counts of pinnipeds.

14-15 - Chuck Oliver traveled to Long Beach, California, to conduct an aerial survey for pilot whales around Santa Catalina Island.

14-20 - Aleta Hohn went to Seattle, Washington, to board the NOAA Ship McArthur for the first leg of the harbor porpoise cruise.

15 - Director Barrett attended a Center/Region program planning session at Terminal Island, California.

15-16 - Fred Kellenberger traveled to San Francisco, California, to attend a PACFIN Data Goals meeting and to meet with

GSA staff on telecommunications; he then went to the Tiburon Laboratory to meet with their ADP staff.

January 17-February 11 - Jay Barlow traveled to Seattle, Washington to board the M/V McArthur for the first leg of the harbor porpoise cruise.

January 21-25 - Dr. Izadore Barrett attended the January 1985 Directors' meeting in Washington, DC.

27-29 - John Carr attended PMC's 1985 Marine Command Seminar in Union, Washington.

January 27-February 2 - Wayne Perryman traveled to Oxnard, California, and San Miguel Island to deploy targets for photogrammetric study.

January 29-February 8 - Jeanne Wexler and Susan Chivers traveled to San Francisco, California, to join the R/V McArthur on a harbor porpoise survey.

February 1 - Dave Mackett traveled to Tiburon, California, to attend a State-Federal groundfish research planning meeting.

6 - Dr. Nancy Lo attended the Marine Recreational Fishery Statistics Survey Coordinators' Meeting at CIC Research Inc., in San Diego. Lo served on the Recreational Fishery Statistics Review Committee.

7 - Alec MacCall and Dan Huppert went to California Department of Fish and Game offices in Long Beach, California, to discuss groundfish research, management and data needs with Herb Frey, Jack Baxter, Rick Klingbell, and Rob Collins.

9 - Jean Michalski, Sandy Hawes, and Aleta Hohn attended a training workshop for the Federal Women's Program in Los Angeles, California.

10-13 - John Carr and Dan Huppert traveled to Union, Washington, to attend the Western Groundfish Conference and to meet with the Limited Access Working Group.

10-14 - Izadore Barrett attended the 1985 Western Groundfish Conference in Union, Washington.

13 - Dan Huppert met with R. Stokes and T. Leschine at the University of Washington's Institute for Marine Studies regarding progress on a contract study of mesh size effects on economic value of a trawl fishery; and with J. Crutchfield and A. Pruter to receive an update report on a contract study of trawl vessel depreciation, repair and maintenance costs.

14-28 - Chuck Oliver traveled to San Miguel Island to assist in tagging and census of northern elephant seals.

19 - Alec MacCall and Dan Huppert met with SWR Director Fullerton at Terminal Island, California, to discuss southern California groundfish research, management and data needs.

19-22 - Izadore Barrett traveled to Honolulu, Hawaii, and Hilo, Hawaii, to attend the Western Pacific Council meeting.

24-26 - Ben Remington participated in a FIMA seminar in Seattle, Washington.

25-28 - Paul Smith traveled to Halifax, Nova Scotia, Canada, to serve as an external examiner for a Ph.D. candidate completing a thesis on advanced acoustic techniques for fishery management.

Pacific Environmental Group

January 7-10 - Paul Sund traveled to La Jolla, California, to attend the Tuna Movements Meeting. He also screened the chartered albacore jigboat logbooks for fishing and wind information.

January 15, February 8, 20 - Andy Bakun, Dick Parrish, and Paul Sund met with Naval architects concerning the construction of the new building P0004.

January 23-24 - PEG cohosted an IGOSS (Integrated Global Ocean Station System) Conference with FNOC.

29-30 - Dick Parrish traveled to La Jolla, California, to attend a meeting on management of Pacific mackerel.

Tiburon Laboratory

January 15 - Norman Abramson and Ed Ueber attended a meeting of the Pacific Marine Fisheries Commission Data Committee in San Francisco.

24-25 - Sus Kato traveled to La Jolla, California, to confer with personnel from the David Starr Jordan, the Southwest

Fisheries Center, and the Scripps Institution of Oceanography, about cruise preparations, satellite imagery and its application to groundfish fisheries, and fishing for grenadier fish.

31 - Sus Kato traveled to Monterey, California, to deliver an experimental euphausiid trawl to a commercial fisherman, and to plan a joint experimental fishing project.

February 10-13 - Norman Abramson, Pete Adams, Michael Bowers, Tony Chess, Mickey Eldridge, Ted Hobson, Bill Leet, Bill Lenarz, Bruce MacFarlane, Sharon Moreland, Ed Ueber, and Tina Wyllie Echeverria attended the 1985 Western Groundfish Conference held in Union, Washington.

21 - Bill Leet and Sus Kato traveled to the Moss Landing Marine Laboratory to confer with Kathy Hauschildt, a graduate student who is nearing completion of her dissertation on correlation of chlorophyll concentration with trawling success.

PERSONNEL ACTIONS

Honolulu Laboratory

January 3 - Mary Lynne Godfrey, Administrative Officer - Voluntary Retirement.

- Annette W. Young, Biological Aid - Intermittent, Temporary Appointment.

16 - Happy A. Williams, Biological Aid - Conversion to Excepted Appointment.

19 - Theresa Villanueva, Biological Science Student Trainee (Jr. Fellow) - LWOP Status.

20 - Jerry A. Wetherall, Supervisory Fishery Biologist (Research) - Promotion.

25 - Susan L. Austin, Biological Technician (Wildlife) - Full-Time Temporary Appointment.

- Michelle L. Reddy, Biological Technician (Wildlife) - Full-Time Temporary Appointment.

28 - Peter G. Bushnell, Fishery Biologist - Part Time Temporary Appointment.

February 7 - Rodney T. Watson, Biological Technician (Wildlife) - Extension of Temporary Appointment.

17 - Richard W. Brill, Fishery Biologist - Conversion to Career Status.

19 - Brenda L. Becker, Biological Technician (Wildlife) - Full-Time Temporary Appointment.

20 - John T. Harrison, Fishery Biologist - Full-Time Temporary Appointment.

20 - Brent M. Miyamoto, Computer Programmer - Extension of Temporary Appointment.

25 - Carrie A. Griffith, Biological Technician (Wildlife) - Full-Time Temporary Appointment.

La Jolla Laboratory

January 5 - Robert Stephens - Resignation.

6 - Betty Stephan, Library Technician - Entered on Duty.

February 2 - Lorna Marquez, Budget and Accounting Technician - Resignation.

2 - Douglas DeMaster, Wildlife Biologist - Resignation.

8 - Lily Tang, Computer Programmer - Resignation.

19 - Dennis Gruber, Biological Aid - Entered on Duty.

27 - Virginia Cass, Fishery Biologist - Expiration of Appointment.

Pacific Environmental Group

January 14 - Lisa Cuddy, Stay-in-School, began work at PEG.

25 - Susie Myers, Stay-in-School, terminated employment.

Tiburon Laboratory

January 1 - Susan Logan, Biological Aid - Termination.

February 3 - William H. Lenarz, Supervisory Fishery Biologist (Research) - Promotion.

TRAINING

Tiburon Laboratory

February 4-5 - Computer consultant Norm Sondak conducted a WordStar class attended by eighteen people.

STATUS OF PUBLICATIONS

Published

Balazs, George H. 1985. Sea turtles and debris: Ingestion and entanglement. Mar. Turtle Newsl. 32:8-9.

Coe, James M., David B. Holts, and Richard W. Butler. 1984. The "Tuna-Porpoise" Problem: NMFS Dolphin Mortality Reduction Research, 1970-81. Marine Fisheries Review. 46(3):18-33.

Gooding, Reginald M. 1984. Trapping surveys for the deepwater caridean shrimps, Heterocarpus laevigatus and H. ensifer, in the Northwestern Hawaiian Islands. Mar. Fish. Rev. 46(2):18-26.

Baited traps were used to assess the geographic and depth distribution of the deepwater caridean shrimps Heterocarpus laevigatus and H. ensifer in the Northwestern Hawaiian Islands. Traps were set in depths ranging from about 290 to 880 m. Both species occurred throughout the length of the chain. Catch rates varied markedly with depth. Highest catches of H. laevigatus were made in 500-800 m with a mean catch rate of 0.91 kg per trap-night. For H. ensifer, optimum trapping depths were 350-600 m with a mean catch rate of 1.66 kg per trap-night.

Henderson, John R. 1984. Encounters of Hawaiian monk seals with fishing gear at Lisianski Island, 1982. Mar. Fish. Rev. 46(3):59-61.

Johnston, Ian A., and Richard Brill. 1984. Thermal dependence of contractile properties of single skinned muscle fibres from Antarctic and various warm water marine fishes including skipjack tuna (Katsuwonus pelamis) and kawakawa (Euthynnus affinis). J. Comp. Physiol. B155:63-70.

Single fast fibres and small bundles of slow fibres were isolated from the trunk muscles of an Antarctic (Notothenia neglecta) and various warm water marine fishes (Blue Crevally, Carangus melampygus; Grey Mullet, Mugil cephalus; Dolphin Fish, Coryphaena hippurus; Skipjack tuna, Katsuwonus pelamis and Kawakawa, Euthynnus affinis). Fibres were chemically skinned with the non-ionic detergent Brij 58.

For warm water species, maximum Ca^{2+}-activated tension (P_o) almost doubled between 5-20°C with little further increase up to 30°C. However, when measured at their normal body temperatures, P_o values for fast fibres were similar for all species examined, 15.7-22.5 $N.cm^{-2}$. Ca^{2+}-regulation of contraction was disrupted at temperatures above 15°C in the Antarctic species, but was maintained at up to 30°C for warm water fish.

Unloaded (maximum) contraction speeds (V_{max}) of fibres were determined by the "slack-test" method. In general, V_{max} was approximately two times higher in white than red muscles for all species studied, except skipjack tuna. For skipjack tuna, V_{max} of superficial red and white fibres was similar (15.7 muscle lengths .

s^{-1} ($L_o.s^{-1}$)) but were 6.5 times faster than the V_{max} of internal red muscle fibres (2.4 ± 0.2 $L_o.s^{-1}$) (25°C).

V_{max} for N. neglecta fast fibres at 0-5°C (2-3 $L_o.s^{-1}$) were similar to that of warm water species measured at 10-20°C. However, when measured at their normal muscle temperatures, the V_{max} for the fast muscle fibres of the warm water species were 2-3 times higher than that for N. neglecta.

In general, $Q_{10(15-30°C)}$ values for V_{max} were in the range 1.8-2.0 for all warm water species studied except skipjack tuna. V_{max} for the internal red muscle fibres of skipjack tuna were much more temperature dependent ($Q_{10(15-30°C)}$ = 3.1) ($P<0.01$) than for superficial red or white muscle fibres. The proportion of slower red muscle fibres in tuna (28% for 1 kg skipjack) is 3-10 times higher than for most teleosts and is related to the tuna's need to sustain high cruising speeds. We suggest that the 8-10°C temperature gradient that can exist in skipjack tuna between internal red and white muscles allows both fibre types to contract at the same speed. Therefore, in tuna, both red and white muscle may contribute to power generation during high speed swimming.

Kaya, Calvin M., Martina K.K. Queenth, and Andrew E. Dizon. 1984. Capturing and restraining technique for experimental work on small tuna in large laboratory holding tanks. Prog. Fish-Cult. 46(4):288-290.

Ralston, Stephen. 1984. Ageing long-lived tropical fish using daily growth increments. ICLARM Fishbyte 2(3):11-12.

Randall, John E., and Stephen Ralston. 1984. A new species of serranid fish of the genus Anthias from the Hawaiian Islands and Johnston Island. Pac. Sci. 38(3):220-227.

The serranid fish Anthias fucinus is described from 15 specimens collected from steep rocky slopes at depths of 168-198 m in the Hawaiian Islands and 214-237 m at Johnston Island. It is unique among the known species of the genus in lacking vomerine teeth. Other diagnostic characters are 9 soft anal rays (of the Indo-Pacific species of Anthias only A. ventralis has this count); 16 dorsal soft rays; 15 or 16 pectoral rays (all unbranched); lateral line with a distinct angle at anterior end of straight peduncular part, the pored scales 34-36 (only A. boulengeri from the Gulf of Oman has this number of pored scales); membranes of dorsal fin not incised; no prolonged dorsal spine (fourth or fifth spines barely longest); and a distinctive head color pattern of alternating stripes of violet and yellow.

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Several events which have occurred over the past few years suggest that the U.S. tuna fishing industry is at another economic crossroad. In the early 1950s the tuna industry faced an economic crisis caused

by the large influx of imported tunas from foreign tuna fishing nations, especially from Japan. The crisis was resolved by a marked increase in productivity due to improvements in the purse seine method of fishing. The introduction of synthetic fiber and the development of the puretic power block were instrumental in the recovery of the tuna industry. Today, the U.S. tuna industry is faced with a number of problems, including lagging sales of canned tuna; a marked increase in imports of tuna, especially water-packed tuna; access problems resulting from extended jurisdiction; tuna resources which apparently are being harvested at near the maximum sustainable yields; and the lack of effective tuna management mechanisms.

This paper briefly describes the current status of the various segments of the tuna industry, including the processors (the canning industry) and the producers (the fishing sector), and the tuna resources and tuna management.

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Hancock Seamounts, within the 200-mile U.S. Fishery Conservation Zone around the Hawaiian Archipelago, were fished in 1972-76 by Japanese trawlers, producing annual catches from 653 to 8,518 metric tons. In 1978-81, U.S. observers accompanied three Japanese trawlers which made six trips to Hancock Seamounts. Observer data indicated that the pelagic armorhead stock had recovered to some extent from the intense fishing prior to 1977. The catch per unit of effort in 1980 and 1981 improved and showed an upward trend.

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